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Engineering News-Record

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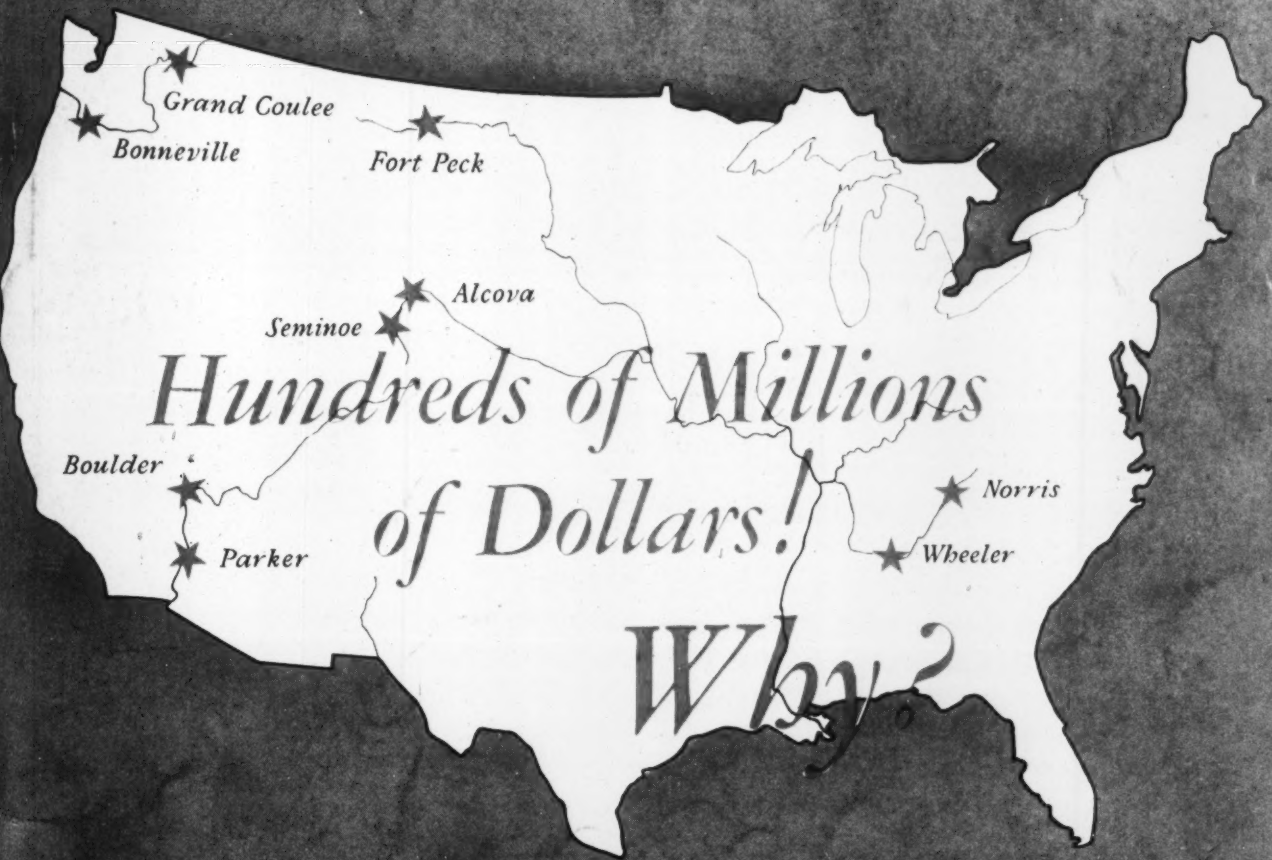
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Fort Peck
Alcova
Seminoe
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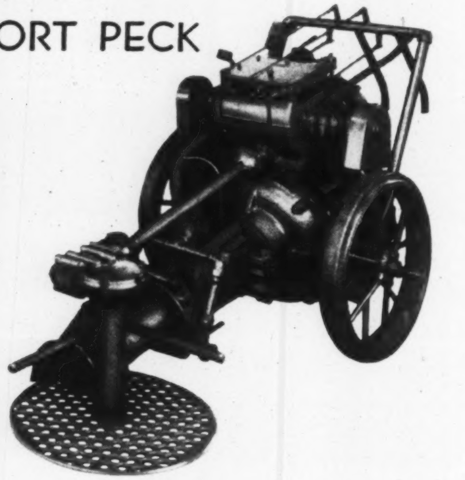

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"A Masterful Job"

DURING the last few weeks the newspapers have published several bits that make interesting reading in the light of the anti-public-works ballyhoo that emerges so punctually to shake its gory locks in the face of each successive Congressional session.

First, the New York Times quotes Frank H. Morse of Lehman Brothers, the bankers, as "hailing the services of the Public Works Administration in providing jobs, constructing public works and aiding the recovery of the municipal bond market, as a model for other governmental agencies." Mr. Morse points out that more than $10,000,000 of the bond issues bought by the PWA have been resold to the public at a premium of more than $250,000; he predicts that the PWA will be able to realize substantially the par value of the great majority of the loans it has made.

Since this prediction, the RFC has taken bids on twenty-four more issues of municipal, district and county bonds to the value of nearly $4,000,000, which it had taken over from PWA. On all except two of them, premiums were bid.

Those who have lived close to the public works project since its inception know that the first practical move toward it was the immediate result of a panicky withdrawal by the investment bankers from the field of public financing just at a time when many cities, towns and other public bodies wanted to finance needed improvements that would help to provide employment for their people. The federal program developed later to meet the growing need for a stimulant to sustain the industries dependent on construction and thereby help toward general recovery.

Those who backed the earlier public works effort will recall also the intemperate opposition of certain groups, notably those in finance, to the federal effort to assist the financing of public works after private agencies had fallen down on the job. They were admonished that they "could not squander their way into prosperity," they were ridiculed and denounced by the whole tribe of kept economists and financial writers for their economic illiteracy and financial irresponsibility. PWA appropriations were contemptuously dubbed "easy money" and the public works advocates were pretty thoroughly damned as ignorant upstarts or public plunderers.

So now, as healing ointment to their sores, comes Mr. Morse's verdict that "the absorption by the PWA of municipal bonds at a time when they were practically unsalable relieved the pressure on the municipal market, thereby creating a scarcity value. We now find many municipal bonds selling at the highest prices in twenty-five years."

And their cup is full as the financial page of the New York Times now graciously concedes that "whatever may be the opinions held in banking circles regarding the functioning of the PWA, bankers are pretty well in agreement that it has done a masterful job in the field of municipal finance." "The PWA," it continues, "bought municipal bonds to further the program of sound public improvements at a time when the general bond market could not absorb the securities. Now that the municipal market is most certainly standing on its own feet, the portfolio of the PWA is being lightened and the bankers are bidding good prices for the bonds."

All of which bids us wonder how come the general bond market "could not absorb the securities?" Was it because the bond merchants raised such a racket when they put up their shutters that they needlessly frightened the market half to death?

However, all this is most gratifying. But how much it would have helped if we could have had so wise an appraisal of the public works effort before the event, when a handful of the faithful were battling to win acceptance for the very truth now so generously conceded.

Incidentally, it may be helpful to remember all this as we listen to the anti-public-works propaganda of the next few months.

Willard Chevalier

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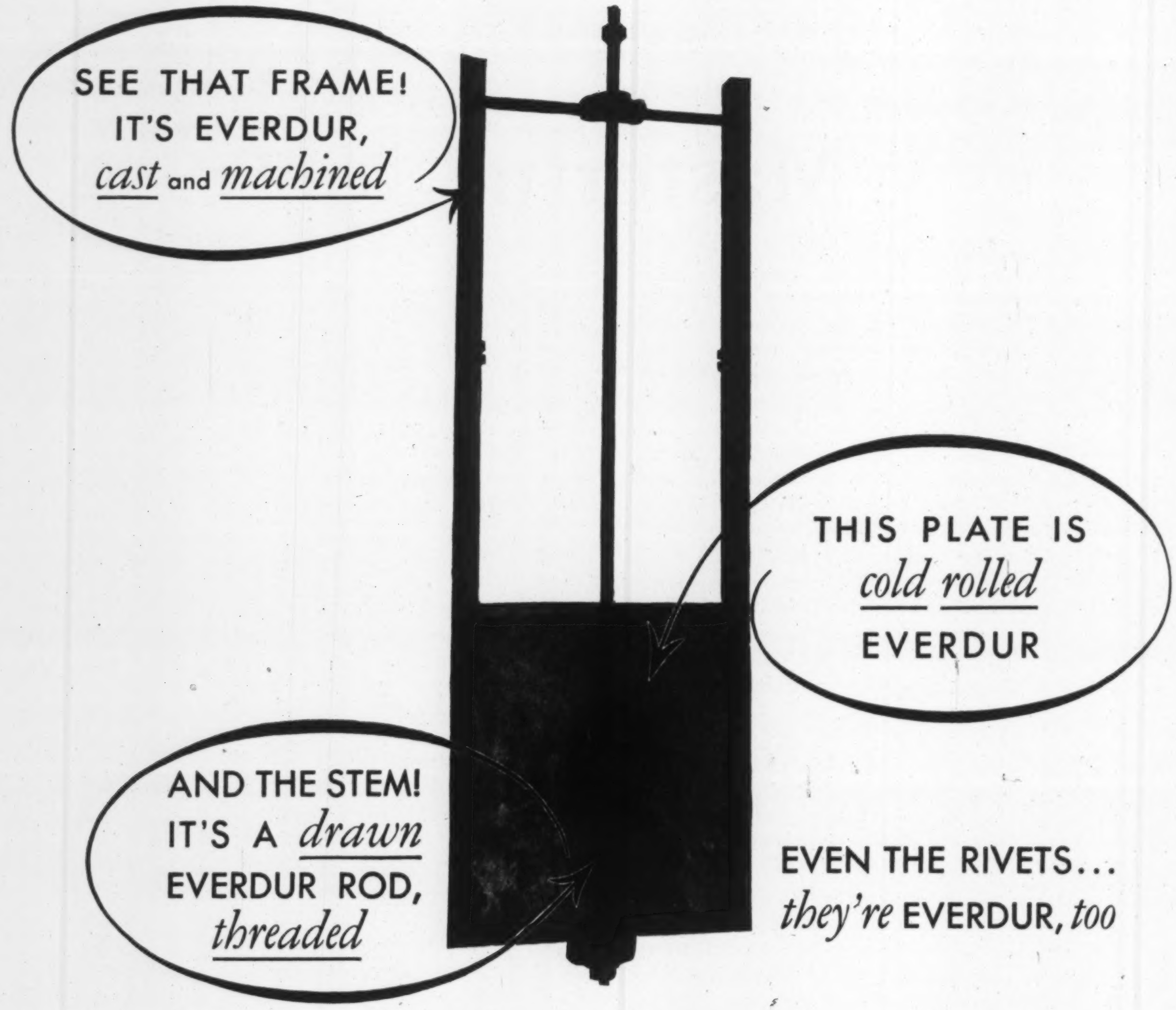
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A Group of Articles on Extraordinary Federal Undertakings

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In the News:

THE TVA has authorized construction of a third large dam, which will be built on the Tennessee River near Pickwick Landing at an estimated cost of $22,000,000.

THE ELECTRIC POWER INDUSTRY has decided to challenge the constitutionality of the New Deal power-development "yardsticks." Data on many of the questions of social need and economic feasibility are presented in this issue.

ON DEC. 1 the completion of the 30-mile construction railroad to the Grand Coulee Dam site will be celebrated. Engineers and contractors on the work probably are all aflutter over the present contest to select a local belle as Queen of the Columbia to assist in the dedication ceremony.

TO ALLOW CONTRACTORS to inspect the mountain dam site in Taylor Park, Colo., before winter makes access impossible, the Bureau of Reclamation has announced the call for bids for which the specifications will be ready next month.

NEXT WEEK, Dec. 5-8, there will be an important series of meetings of the construction code authorities in Knoxville, Tenn., devoted to a more complete integration of the industry under the codes.

APPROVAL of the official plan for carrying out the $34,500,000 program of the Muskingum Watershed Conservancy District, Ohio, by the Watershed Conservancy Court assures early construction work on the several dams for which bids have already been received.

This Special Issue:

THIS SPECIAL ISSUE of *Engineering News-Record* has been prepared to bring together in convenient form the data that are essential to an understanding of the potentialities and purposes of the great federal undertakings that are receiving so much public attention: Grand Coulee and Bonneville dams on the Columbia; Boulder and Parker dams on the Colorado; Fort Peck on the Missouri; Alcova and Seminoe on the North Platte; and Norris, Joe Wheeler and Pickwick Landing dams in the Tennessee River Basin.

Engineers ask themselves or are asked by others as to the purpose of these undertakings, as to their economic justification and how they fit into a logical plan for the development of the regions in which they are located.

At most of these projects, power is to be generated; hence the market for the power and its effect on the market for power of existing electric utilities is of special importance. This is indicated by the recent announcement of the Edison Electric Institute that it proposes to attack the constitutionality of the acts under which the government is building its great power plants.

The total amount of power-generating equipment to be installed initially in the projects discussed in this issue is shown in the accompanying table. While the initial installations are not as large as many of the current rumors indicate, still they are large enough to raise serious question as to where a market for the power is to be found. Special attention has been given in this issue to that question as it relates to the larger plants, namely those in the Pacific Northwest and Southwest and those in the Southeastern states.

Dam	Power Installation, in Kw.		Cost Initial Development
	Initial	Ultimate	
Bonneville....	86,000	430,000	$32,500,000
Grand Coulee.	102,900	617,000	63,000,000
Boulder......	370,000	1,355,000	133,000,000
Parker.......	....	80,000	13,000,000
Fort Peck.....	50,000	50,000	84,000,000
Alcova.......	....	....	15,900,000
Seminoe......	38,400	38,400	6,100,000
Norris........	100,000	100,000	34,000,000
Wheeler......	32,000	256,000	28,000,000
Pickwick.....	....	204,000	22,000,000
	779,300	3,130,400	$431,500,000
Approx. hp.......	1,000,000,	4,000,000	

But if, as many believe, the unit consumption of power can be greatly increased, these large additions to present power supply may be successfully absorbed.

Coming Articles:

REFLECTING the continued advance in concrete batching, mixing and handling equipment, and at the same time reviewing two important features of the construction work at Norris Dam, two articles will soon be published describing the mixing-plant layout and operation for turning out 1,500,000 cu.yd. of concrete and the two 1,928-ft. cableways used for concrete placing. The batching and mixing plant exemplifies the modern trend toward greater automatic operation.

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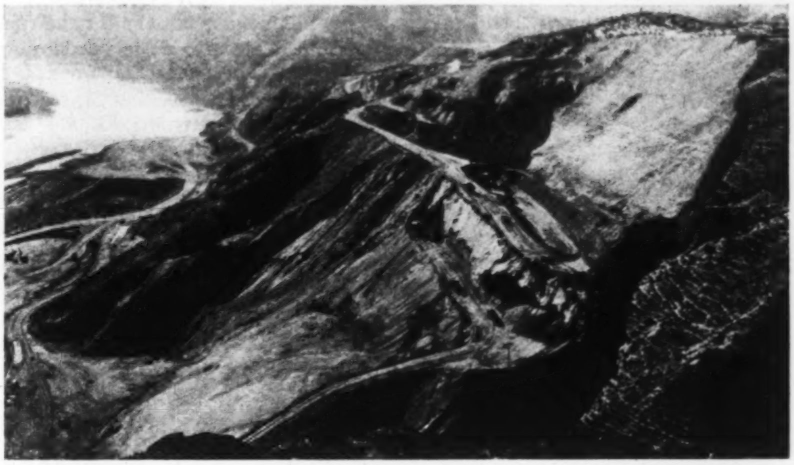


MOVING VAST QUANTITIES of earth and rock is one of the outstanding elements of some of the projects reviewed in this issue. In the work here shown at the Grand Coulee Dam site on the Columbia River the shovels and trucks are dwarfed by the great size of the cuts and fills.

Undertakings Without Precedent

Editorial foreword to a series of articles of an extraordinary group of federal public-works projects now under construction

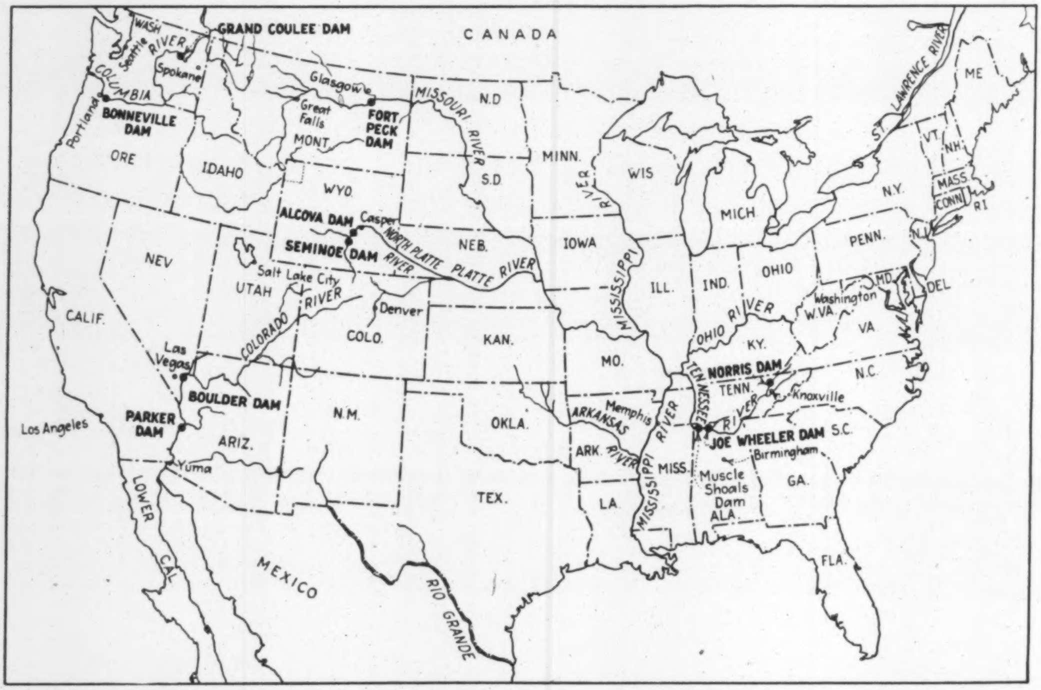
THE federal government at the present time is engaged in the construction of a group of great projects for power development, flood control, navigation or water conservation, projects that will cost in the neighborhood of $400,000,000 and will increase the nation's power-producing capacity by one million horsepower. In the Northwest the government is building a $63,000,000 dam for power development on the Columbia River near the mouth of the Grand Coulee, and at Bonneville on the same river it is building a combined power and navigation dam costing $32,000,000. In Black Canyon on the Colorado the government is building Boulder Dam, the greatest concrete dam ever attempted by man. At Fort Peck on the upper Missouri River the world's largest earth dam, estimated to cost $84,000,000, is under construction to regulate the flow of the Missouri as an aid to navigation, and, incidentally, to produce power and provide water for a limited amount of irrigation. On the North Platte River in Wyoming a power and storage dam is to be built at Seminoe, and below it, near Casper, work has begun on a diversion dam and irrigation project, the whole to cost $22,000,000. And, finally in the Southeast there is under construction Norris Dam on the Clinch River, costing $34,000,000; on the Tennessee River there is Joe Wheeler Dam, costing $23,000,000; and, as recently announced, Pickwick Landing Dam at a cost of $22,000,000, all three being built by the Tennessee Valley Authority with federal funds. Except for Norris Dam and the work on the Colorado River, this work is all being carried forward without specific Congressional approval, being authorized under the broad powers granted the President under the Recovery Act. Further, these projects are outside the normal program of river control and land-reclamation work carried on by the Corps of Engineers and the Bureau of Reclamation, work planned far in advance of execution and undertaken only as authorized by Congress.

THIS is an unprecedented situation. For those who would look beyond the present spectacular construction operations to inquire into the purpose of the undertakings, it raises questions whose answers either never have been given or have been obscured by other matters. Why were these projects undertaken? How do they fit into plans for the orderly development of the river system on which they are located? How are they related to the economic development of their respective regions? Are they economically justified, either in part or as a whole? Is there a market for the power to be developed? Are the power plants logical additions to the power systems of the region in which they are located, or must the government enter into direct competition with existing electric utlities in order to develop a market? Will the land to be irrigated ever produce a return on the investment?

These and similar questions are being asked by engineers on all sides. In this issue an attempt is made to answer as many of them as possible by setting forth the known facts upon which answers must be based.

ASIDE from their function in the employment-for-recovery campaign, these projects, other than those on the Colorado River, are outstanding physical expressions of a leading New Deal characteristic—the willingness to try out a promising or attractive idea even at stupendous cost, regardless of whether it meets the test of sound business procedure. It is what the President has often described as the experimental approach to the solution of national problems. Only the dire national emergency justified the method, of course.

With the exception of the great works on the lower Colorado and part of the construction work undertaken by the Tennessee Valley Authority, the projects are outgrowths not of planning and economic determination of service value, but of the dictatorship vested in the President by the emergency laws enacted by Congress in early summer of 1933. Social objectives and the desire to set up regulatory public power systems evidently were the motives in part. Political reasoning appears to have entered, at least to some extent. For example, Grand Coulee had never been planned as a government power enterprise, but instead had been conceived as part of a huge regional development based on irrigation, with power in large part a service feature for irrigation pumping. In this scheme the dam and power plant were to cost nearly $200,000,000; and the whole project, because of its vast size in both money and other elements, was regarded as being far in the future. But local political demand for it was strong. The Administration, unwilling to allocate to the state of Washington so large a sum, fixed the amount at $63,000,000 to be spent for a power enterprise alone, and it then became necessary for the engineers of the Bureau of Reclamation to design a dam and power plant to fit this sum. In effect, the present Grand Coulee represents not a project that was worked out on its own merits but merely $63,000,000 worth of dam.


GRAND COULEE DAM
CANADA
WASH
Seattle
RIVER
Spokane
COLUMBIA
Portland
BONNEVILLE DAM
ORE
IDAHO
Glasgow
Great Falls
MONT
FORT PECK DAM
MISSOURI RIVER
N.D
S.D
MINN.
WIS
RIVER
WYO
ALCOVA DAM
Casper
SEMINOE DAM
NORTH PLATTE RIVER
PLATTE RIVER
NEB.
IOWA
NEV
Salt Lake City
UTAH
RIVER
COLORADO
Denver
COLO.
KAN.
CALIF.
Las Vegas
BOULDER DAM
PARKER DAM
Los Angeles
ARIZ.
Yuma
N.M.
OKLA.
TEX.
LOWER CAL
MEXICO
RIO GRANDE
MICH
MISSISSIPPI
ILL.
IND.
OHIO
OHIO RIVER
MO.
KY.
NORRIS DAM
TENN.
TENNESSEE RIVER
Knoxville
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ARKANSAS RIVER
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Washington
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PENN.
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N.Y.
ST. LAWRENCE RIVER
VT.
NH.
ME
MASS.
CONN
RI

NINE DAMS, two of them of unprecedented magnitude, now are under construction by the federal government as part of an extraordinary program of power development, navigation improvement, flood control and irrigation water supply.

And while even this minor Grand Coulee Dam alone could supply all of the unsatisfied power needs of the Northwest states for many years, Oregon too sought something for itself. Authorization of Bonneville resulted.

SIMILARLY, the construction of Fort Peck Dam, of the Casper-Alcova irrigation project and Seminoe Dam was authorized in response to urgent political pressure rather than on a demonstration of economic necessity. When the Public Works Administration came to hand out large sums for federal work, those who represented Montana and Wyoming in Congress found that these states had little coming their way. Naturally they were concerned about it. A hurried search for projects that might be put forward revealed that the army engineers, in preparing routine studies for the development of the Missouri River, had included an enormous reservoir at Fort Peck, Mont., as an essential element to the development of 9-ft. navigation on the lower river. Construction of the reservoir, it is to be noted, however, was not recommended, as engineers who prepared the report could find no economic justification for it. But apparently pressure was brought to bear on the War Department for a favorable finding between the time the report was submitted by the division engineer and the time the Fort Peck Dam came up as a subject for PWA financing, for the project finally was proposed to the PWA by the War Department with a favorable recommendation that finds little support in the district engineer's detailed study. Be it said, however, that the Fort Peck project had this in its favor as a Recovery Act undertaking: it did have good possibilities for producing employment quickly.

The Casper-Alcova irrigation project has an involved history, as is set forth in more detail elsewhere. It is sufficient to say here that while there is little doubt that a successful irrigated area adjacent to Casper would be very beneficial to that part of Wyoming, yet the land costs of the Casper-Alcova project are so high as to make the practicability of the project very questionable, and the matter of water supply was so unsettled when the project was authorized as to have made it apparent that work on the project could not be undertaken promptly. Power is relied on to fill up the gap between cost and return.

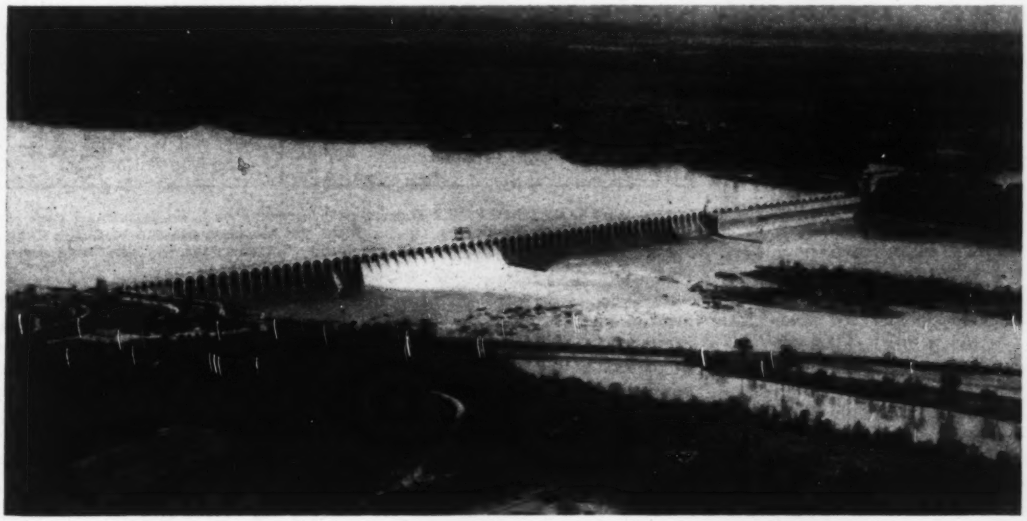
Events leading up to the present undertaking of the Tennessee Valley Authority represent a rather different approach. The influence of Senator Norris, political friend of the Administration and long a fighter for public control of the ill-starred Muscle Shoals power scheme of war days, cannot be disregarded; he wanted and obtained authorization for a great public power development project. But to this power development plan with which he was very sympathetic the President succeeded in attaching a great regional planning and development scheme. The Tennessee Valley, in size a province or kingdom, is to be lifted up by a grand type of paternalistic commission guidance and control to a new economic and social level, with power as the major tool of control.

THE FAVORABLE attitude of the Administration toward public power development also had an important bearing on the financing of these projects. President Roosevelt went into the White House in 1933 fresh from a long contest with the electric utility interests in New York State, which resulted in the establishment of the New York State Power Authority, created expressly to undertake development of the great power resources of the international section of the St. Lawrence River as a means of checking the further exploitation of the state's power resources for private profit. In Washington he found the federal government already committed to a large power-generation program in the Southwest at Boulder Dam, and with a white elephant on its hands in the Southeast in the shape of the power plant at Muscle Shoals. Through the establishment of the Tennessee Valley Authority to take over the latter plant and supplement it with other plants, the President saw that it would be possible to dominate the power market in the Southeast. Thus there was soon to be at hand what he termed a "power yardstick" both in the Southwest and Southeast. To round out control of the country, similar domination was needed in the Northwest and the Northeast. The St. Lawrence ultimately, the President believes, will provide a yardstick in the latter region; there remained still the Northwest to be provided for. Bonneville and Grand Coulee provide that yardstick. The Bonneville project in theory is a navigation aid but it will produce a large amount of power. The Grand Coulee Dam as now being built has power generation as its only objective.

THIS is the background against which the several projects discussed in this issue must be viewed. From a survey of the factors affecting the projects it will be seen that no one of them is so sound financially as to make it an attractive undertaking. But in an emergency like the present one the government is justified in looking beyond the immediate direct return to see whether an undertaking is sufficiently desirable as a national asset to warrant its construction.

Thus it is difficult to formulate a binding rule as to whether or not the federal government is justified in putting up the money to pay the cost of the projects reviewed in this issue. It should, however, be possible to state a general rule that no great power development should be undertaken without first having reasonable assurance that the power can be marketed in reasonable time without entering into destructive competition with existing plants. Were this rule applied, it is evident that some of the projects considered in this issue would not be undertaken.

MUSCLE SHOALS is expected to be removed from the "white elephant" class by making it an integral part of a great power system being developed by the Tennessee Valley Authority.



Power, Navigation and Irrigation in Two Projects on the Columbia

Bonneville and Grand Coulee dams being built by federal government—Bonneville for power and navigation and Grand Coulee for power alone, but ultimately as an essential element in a great irrigation scheme—Market for power a major unanswered question.

ON THE COLUMBIA RIVER in Washington and Oregon the federal government, with PWA funds, is building two great projects; Bonneville Dam, under the direction of the Corps of Engineers, because it is partly a navigation project; and Grand Coulee Dam, under the direction of the Bureau of Reclamation, because it is closely associated with the proposed irrigation of 1,200,000 acres of land in the Columbia Basin irrigation project. On both of these projects it is planned to develop large blocks of power; hence their commercial success, quite apart from their functions as relief measures, depends upon finding ways and means of expanding the present power market so as to absorb this new energy. That problem, and the question of what the power rates shall be, are engrossing matters in the Northwest today.

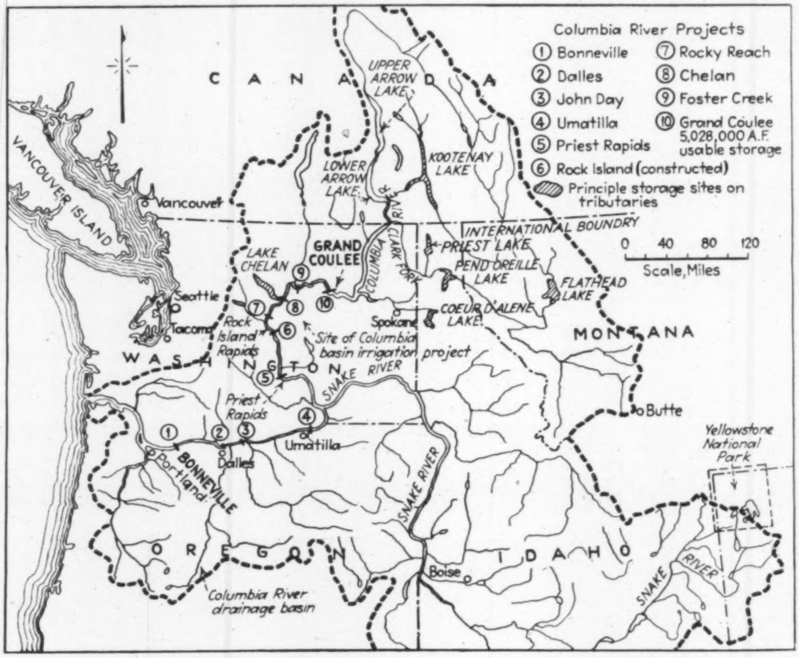
The Columbia River played a prominent role in the early history of the Northwest, and until 1883, when the railroad from Portland to Spokane was completed, travel through its valley was principally by river boat. At the present time the lower river is an important waterway, and ocean-going ships follow its channel more than 100 miles inland to the city of Portland at the confluence of the Willamette and Columbia rivers. Although lumber and wheat are the principal commodities attracting ocean-going shipping, the large inland area for which Portland is the center and shipping point has developed a wide variety of trade.

Quite unlike the Colorado River, the other Western stream on which a great federal project is under way, the Columbia traverses a heavily timbered country of which some portions have a heavy rainfall, with correspondingly high runoff. Moreover, the river is and probably always will be considered as a navigable stream for over 200 miles above the mouth. Thus, navigation is a factor in development plans for the lower river. The Bonneville project, for example, although 140 miles from the ocean, includes in its budget $3,100,000 for a lock that will pass a ship 500 ft. long, drawing 26 ft.

Navigation, however, is an unimportant element of the present undertakings; their principal objective is the development of power, to provide the federal government with one of the four yardsticks with which the present administration hopes to be able to measure the reasonableness of the power rates of the privately-owned electric utilities.

Irrigation has no official place in the present operations, but it stands offstage, as it were, at Grand Coulee, ready to step forward as the real justification for that great undertaking. The present low dam at the Grand Coulee is useful only for the development of power; but a high dam at the same site will raise the river level to a point where it will be practicable to use secondary power developed at the dam to pump water to irrigate 1,200,000 acres in the so-called Columbia basin, a semi-arid region lying to the east of the Columbia River and north of the Snake River where the two join. Without the people and new commerce that the irrigation project will bring, the present power project bids fair to become as great a white elephant as the plant at Muscle Shoals.

There is good reason to believe that those who first asked for PWA funds asked for money for both the high dam and the initial development of the irrigation project, estimated to cost $377,000,000 for the complete development; but they are reported to have been told that they could have $63,000,000 for a power dam at the Grand Coulee site (which amount subsequently was allotted). The dam and power plant now being built are estimated to cost that much. Both are designed so that the high dam can be built later without difficulty. Construction of the high dam and inauguration of the irrigation project now are being actively advocated.


Columbia River Projects
① Bonneville
② Dalles
③ John Day
④ Umatilla
⑤ Priest Rapids
⑥ Rock Island (constructed)
⑦ Rocky Reach
⑧ Chelan
⑨ Foster Creek
⑩ Grand Coulee 5,028,000 A.F. usable storage
▨ Principle storage sites on tributaries
CANADA
UPPER ARROW LAKE
LOWER ARROW LAKE
KOOTENAY LAKE
VANCOUVER ISLAND
Vancouver
INTERNATIONAL BOUNDRY
0 40 80 120
Scale, Miles
GRAND COULEE
LAKE CHELAN
COLUMBIA
CLARK FORK
PRIEST LAKE
PEND OREILLE LAKE
FLATHEAD LAKE
COEUR D'ALENE LAKE
Seattle
Tacoma
Rock Island Rapids
Spokane
Site of Columbia basin irrigation project
MONTANA
WASHINGTON
SNAKE RIVER
Priest Rapids
Umatilla
Butte
Yellowstone National Park
BONNEVILLE
Portland
Dalles
OREGON
IDAHO
Boise
Columbia River drainage basin
SNAKE RIVER

THE COLUMBIA RIVER drains a great intermountain basin, including a large part of the states of Washington, Oregon, Idaho and Montana, also part of British Columbia. This map shows the principal power sites, including the two now being developed.

Flood control (other than as a water-conservation measure) is of importance only below the point where the Co-

TABLE I—PROPOSED POWER DEVELOPMENTS ON THE COLUMBIA RIVER AND THEIR MAIN FEATURES

Dam Site	Miles from Pacific	Normal Pool El. (Above Sea Level, Ft.	Proposed Power Install. Kw.	Estimated Constr. Costs (Exclusive of Locks)	Dam Height, Foundation to Normal Pool Ft.	Max. Power Head	Useful Storage, Acre-Ft.	—Flow for Period 1913-1930— Min. Sec.-Ft.	Mean	Max.	Flood of June, 1894
Grand Coulee	597	1.287.6	1,575,000	$171,000,000	475	351	5,028,000	17,000	109,000	462,000	725,000
Foster Creek	546	928 6	691,000	49,000,000	205	164	*36,000	17,000	109,000	492,000	725,000
Chelan	504	762	450,000	39,000,000	137	92	*47,000	17,600	113,000	500,000	735,000
Rocky Reach	474	665	336,000	38,000,000	80	59	*20,000	20,300	117,000	510,000	735,000
Rock Island	453	599	60,000	(built)	119	50	*10,000	21,000	121,000	528,000	740,000
Priest Rapids	397	540	644,000	63,000,000	192	131	*160,000	21,000	121,000	528,000	740,000
Umatilla Rapids	292	330	910,000	60,000,000	104	70	*135,000	40,000	185,000	800,000	1,170,000
John Day	213	258	1,080,000	110,000,000	159	102	*250,000	40,000	185,000	800,000	1,170,000
The Dalles	192	150	1,370,000	84,040,000	260	75	*80,000	40,000	185,000	800,000	1,170,000
Bonneville	140	72	430,000	42,000,000	140	64	100,000	43,000	190,000	800,000	1,170,000
		Totals	7,546,000	656,100,000**							

*Pondage with 5-ft. fluctuation of forebay.
**Exclusive of Rock Island.

lumbia debouches from its gorge, about 125 miles from the ocean.

Both the Bonneville and Grand Coulee projects were undertaken hurriedly in the late summer of 1933 at the request of representatives of Oregon and Washington, in order to create work in that part of the country. Both are being paid for by the national government as federal undertakings. No study of power markets was made in advance of the allotment of funds, to determine the economic soundness of the projects, as is required by the PWA in the case of state or municipal projects for which it gives only 30 per cent of the cost outright; hence little is known as to the usefulness of the project beyond the immediate employment and materials and equipment market that they create. However, the region has extensive natural resources that are largely undeveloped. The matter of building a market for the power, then, is a question of prime importance at both Bonneville and Grand Coulee, especially at the latter because Bonneville is located near a large city at tidewater. At what rates power can be sold to make the projects pay, or must be sold to attract new industries and develop larger markets, and the effect on existing private and public utilities of any sales policy that may be adopted are still unanswered questions. In the following, the physical factors relating to the projects are outlined, and some of the power questions are reviewed.

Hydrology

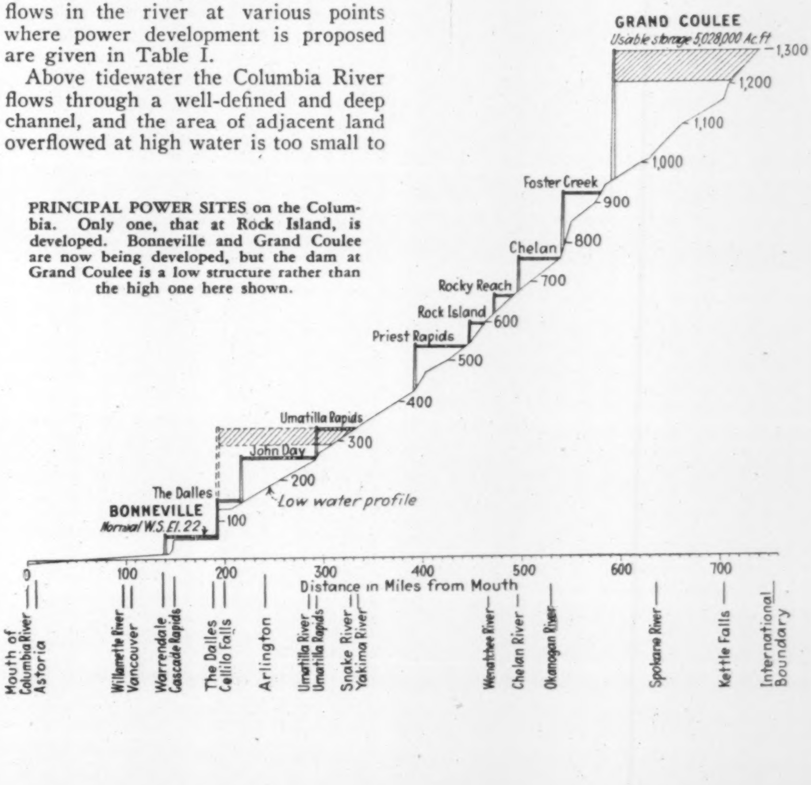
The Columbia River proper has a total length of 1,210 miles; it rises in British Columbia in Columbia Lake, about 30 miles north of the international boundary. One of its tributaries, the Kootenay, is really the upper portion of the same drainage basin under a different name. The Kootenay rises in British Columbia, flows southeasterly across the boundary and through United States territory for 167 miles before turning north into Kootenay Lake, whose outlet is a tributary of the Columbia. In these upper portions of the basin, parts of which are in British Columbia, Montana, Idaho and Washington, there are large lakes that afford storage possibilites amounting to a total of nearly 18,000,000 acre-ft. These large storages are factors in river flow regulation.

About half way from the Canadian border to the sea, the Columbia is joined by the Snake River, itself a very extensive stream, with a total length of 1,036 miles, draining all of southern Idaho and part of southern Oregon.

Above the mouth of the Snake the profile of the Columbia River is a succession of steep slopes connected by lines of less grade, the concentrations of steep gradient being Kettle Falls, Grand Rapids, Rock Island and Priest Rapids. The total fall in this section of the river is 975 ft., or an average of 2.3 ft. per mile. Between the Snake and tidewater the total fall is only 309 ft., or an average of 1.7 ft. per mile, with concentrations of drop at Celilo Falls and Cascade Rapids. The total fall from the Canadian border to tidewater, at low stages of the river, is 1,284 ft. The low, mean and maximum flows in the river at various points where power development is proposed are given in Table I.

Above tidewater the Columbia River flows through a well-defined and deep channel, and the area of adjacent land overflowed at high water is too small to warrant special consideration. Along the tidal section of the river, however, the wide valley floor includes a considerable area of fertile land subject to inundation. This involves a flood-control problem. Actual flooding of the unleveed lowlands along the tidal section of the river begins when river flow reaches a height of 11.2 ft. on the Longview gage, corresponding to a discharge at that point of about 600,000 sec.-ft. Little damage is done until the discharge reaches 700,000 sec.-ft. This quantity of flow may be expected to occur once in about three years and to have a duration of 4 to 42 days. About 119 sq.mi. are more or less protected by existing levees. The 127 sq.mi. of unleveed lowland is largely in small parcels that would involve separate levee-protection projects.

The largest floods on the lower Columbia occur when maximum flow from the Snake comes at a time of floodflow



PRINCIPAL POWER SITES on the Columbia. Only one, that at Rock Island, is developed. Bonneville and Grand Coulee are now being developed, but the dam at Grand Coulee is a low structure rather than the high one here shown.

in the Columbia. The flow of 1894, the greatest of record both above and below the mouth of the Snake, was produced by unusual combinations of melting snow and heavy spring precipitation. Maximum flood runoff from the upper basin occurs usually in June.

Navigation

From a navigation viewpoint the Columbia River is divided naturally into three parts: (1) The tidal section extends from the mouth about 140 miles upstream. This extends well beyond the city of Portland, which is situated near the mouth of the Willamette or about 111 miles by river channel from the ocean. (2) The middle section of the river extends from the head of tidewater to the mouth of the Snake, about 180 miles upstream. And (3) the upper section of the river is from the Snake to the international boundary, about 424 miles from the ocean.

Although railroads and highways largely have supplanted the river as a means of communication and rapid transit, improvement of the channel between Portland and the sea has made possible navigation by ships of large size, and water traffic has become an important factor in the commerce of the lower Columbia River Valley.

Ocean traffic destined for the Portland waterfront turns off the Columbia River into the Willamette in which the city docks have been built. Up the Columbia River above Vancouver, Wash., which lies across the river from Portland, the only river traffic now is by small vessels. Two locks on the Columbia that have been factors in navigation thus far are as follows: Cascade Locks, at mile 148 above the river's mouth, is a two-chamber flight lock with a usable length of 462 ft. in the shorter chamber, a total low-water lift of 24 ft., and a depth over the sill at low water of 8 ft. The Dalles-Celilo Canal, completed in 1915, is 8.6 miles long, and its lower end is at mile 188. This canal includes four locks with a 265-ft. usable length, 45-ft. width and controlling depth at low water of 7 ft.

Although the controlling depth of the lock and channel system was to have been 7 ft., the river at times has fallen as much as 2½ ft. below the stage that would give that depth at Cascade Locks, the first to be encountered in going upstream from tidewater. These locks, located about 4½ miles above the Bonneville site, will be flooded out by the Bonneville Dam, where a much larger lock is being installed.

Revised plans for the Bonneville project call for a ship lock 76 ft. wide, 500 ft. long, with a depth over the sill of 27 ft. at ordinary low water. This will be a single high-lift lock, the lift ranging from 45 ft. at high water to a maximum of 66 ft. at low water. It will accommodate shipping of much greater drafts than will the present channel below the dam, but the improvement of this channel, contemplated at some later date, has not been recommended for immediate construction. Installation of the ship lock was approved as part of the present project because economies could be effected by building the lock to its ultimate size now while other improvements are under construction.

Above The Dalles to the mouth of the Snake River (mile 323) the limiting draft for all-year navigation now is 4½ ft. Although there is little or no navigation at the present time in this stretch of the stream, it was a factor in local commerce before land facilities were developed.

Irrigation

Throughout much of the Columbia River basin east of the Cascades, except at higher altitudes where topographic conditions are unfavorable to agriculture, rainfall is generally insufficient for crops. The abundance of water in the streams has been a challenge to the settler. As a result, the total area of land in the Columbia watershed now under irrigation is about 4,000,000 acres. This includes the major part of the land which can be irrigated at low cost, most of which is on tributary streams. The total area of undeveloped irrigable land is approximately 2,000,000 acres, about three-fourths of which lies above the mouth of the Snake and is largely within the area proposed for development under the Columbia Basin project.

Power possibilities

An exhaustive study of power possibilities on the Columbia River was made some years ago by the army engineers as one of the so-called "308 Reports" authorized under an act of Congress passed in 1927. In that study ten sites for power development ultimately were selected, and a general program of river development was laid out which would utilize 92 per cent of the available head from the Canadian border to tidewater. This series of generating plants is estimated to have an ultimate capacity of 7,546,000 kw.

The foregoing figures for total power development do not include 4,775,000 kw. on the tributaries of the Columbia.

Storage already has been developed on Cœur d'Alene and Chelan Lakes, and construction is now in progress on a project to regulate Flathead Lake. A large reservoir can be developed at the Hungry Horse site on the south fork of the Flathead River in Montana, and a smaller one on the Chiwawa River in Washington. More storage possibilities exist on the Snake and other tributaries. Aside from storage behind the Grand Coulee Dam, a total of about 14,000,000 acre-ft. of storage can be provided on the upper Columbia and its tributaries. Of this, 10,000,000 acre-ft. would be in the Snake River watershed and about 2,000,000 acre-ft. on tributaries of the main stream below the mouth of the Snake.

Most of the power that has been developed in the watershed has been developed on the tributaries, chiefly for the reason that while the possibility of generating large blocks of cheap power on the main river has long been recognized, yet the large initial investment required as well as the necessity for a large base load has kept private capital from undertaking development of most of the power sites. The only one that has been developed is the Rock Island site, undertaken just before the business depression began.

Bonneville Project

BONNEVILLE is located at the upper limits of tidal effect on the Columbia River about 140 miles from the mouth and 4½ miles below Cascade Locks. The project includes the dam, power house, fishways and navigation lock. Originally the development as a whole (with two of the ten ultimate power units) was estimated to cost $31,000,000, but since the early estimates were made revision has appeared necessary, so that now the estimated figure for the total cost (two units) is about $39,000,000.

The first appropriation for work on this project was made on Sept. 28, 1933. Since that time contracts have been let for about half the total sum appropriated, and the work has been advancing rapidly in various departments of the project as a whole. The work is under the direction of the Corps of Engineers.

The Bonneville project does not involve any irrigation features; the pondage behind the dam is only for the purpose of regulating the flow through the power house. A low dam is being built with a normal pool level about 72 ft. above the average level of the stream prior to development. Hence there is no storage that could function in flood control. Navigation also is incidental for the time being (until the channel below the dam is improved), as only barge navigation is affected.

From this it is apparent that the project as it is now being built is primarily for power development. What percentage of the total cost will be charged to navigation remains to be seen. The cost of the features that are being built exclusively for navigation will be $3,100,000 as the allotment now stands ($1,900,000 on the originally planned barge lock and $1,200,000 more allotted for the extra cost of the ship lock), but it is now thought likely that the actual outlay on navigation before the project is finished will be closer to $4,000,000. As navigation of the river above the dam will benefit from its construction, some part of the cost of that structure doubtless will be credited to navigation benefits.

The ultimate capacity of the power plant will be 430,000 kw., of which the present plan contemplates the installation of only two 43,000-kw. units. The prospective market for energy developed in this power house is discussed on p. 685 under the head of "power markets."

A comprehensive review of the Bonneville power project was published in *ENR*, Nov. 1, 1934, p. 547.

There is no definite date set at which power from the Bonneville plant can be guaranteed to be ready for delivery.

Thus far a definite sum has been allotted to the project ($32,450,000), of which assignment has been made to various divisions of the work. Recently it has developed that certain items would be more costly than was contemplated when the budget was made up. For example, the plans on which the budget was made include a fishway to cost $800,000, but the type of fishway that could be built with this money was not acceptable to fishery interests, so that last summer—at a time when commitments or actual contracts had been made on many other items of the work—the fishery interests insisted on the adoption of fishway construction that would cost almost $3,000,000. From this it is apparent that the present budget must be exceeded or economies made elsewhere on the work.

An item on which no commitment has yet been made although bids have been received) is a contract for the two turbines for the power house. When the bids were received they were found to be 15 to 20 per cent above the estimates. The high price was given as the reason for rejecting all bids. That was last August. Although no announcement to that effect has been made, it is commonly believed that the lack of any call for new bids on power machinery is due to the fact that high fishway costs delayed commitment on purchase of powerhouse equipment. However, it is understood that bids will be called soon.

Columbia Basin Irrigation Project

THE COLUMBIA BASIN irrigation project has a long history behind it. While Bonneville and Grand Coulee dams are comparatively new as federal undertakings, the entire Columbia basin project as a proposed state venture has been the subject of repeated analytical studies, debates and animated controversy for some fifteen years at least. In this period a variety of development plans have been proposed; some involved gravity delivery of water, others proposed pumping; the boundaries of the land to be irrigated have been shifted back and forth to correspond with different points of view in analyzing soil studies and estimating the amount of development charges which settlers could be expected to meet. Out of this long preliminary period of study of the project has come much information that will be valuable when development is undertaken—and out of some of the studies come warnings to proceed slowly in bringing in expensive land that may not be able to pay return on the investment.

Under the gravity delivery plan, the favored storage was in Pend Oreille Lake in Idaho where the necessary storage can be obtained within a lake-level range of 12½ ft. Other storage locations were Flathead Lake in Montana and Priest Lake in Idaho. The gravity plan called for a main conduit about 130 miles long from Albany Falls to Hillcrest, comprising 33½ miles in tunnel, 34 miles in lakes, about a mile

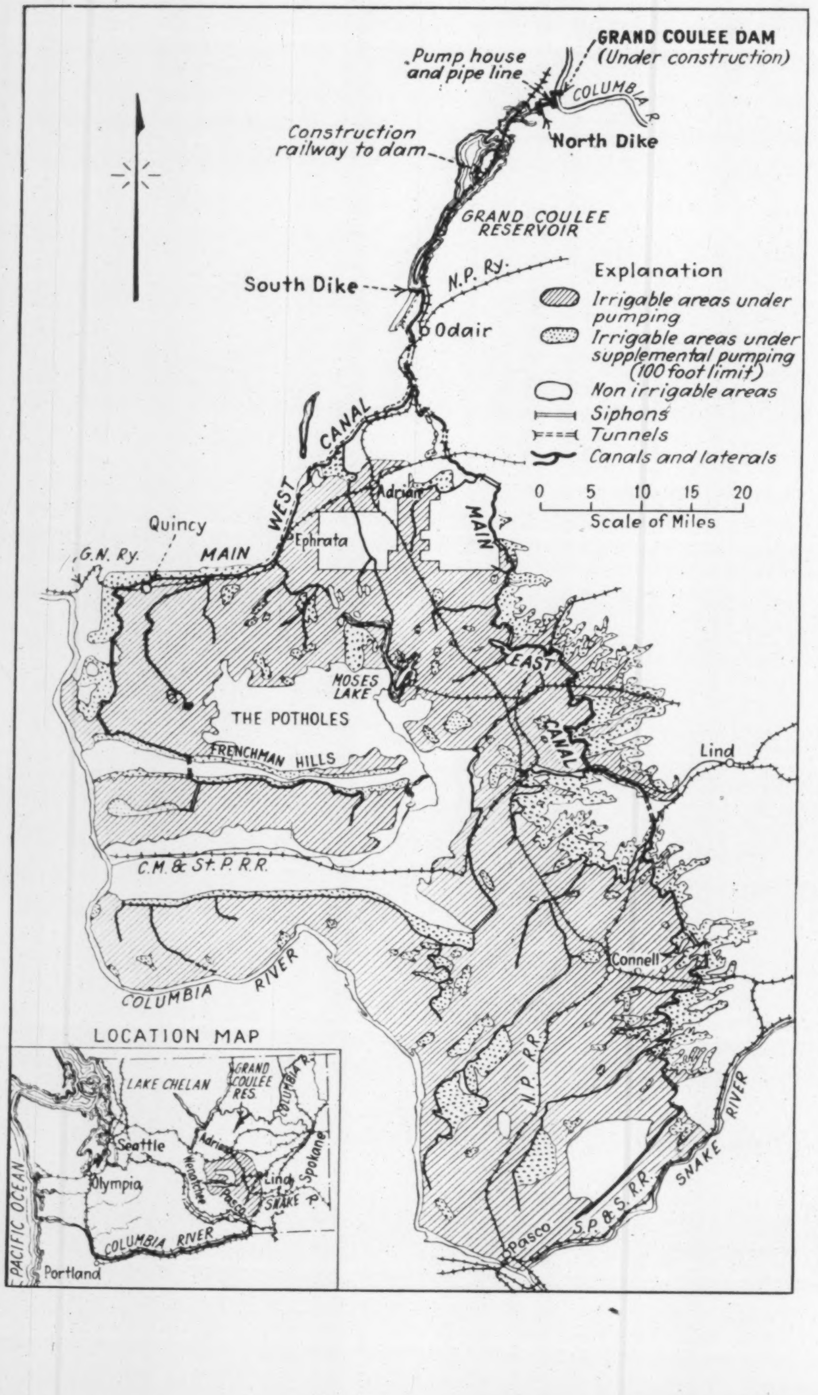
BONNEVILLE DAM is being built across the Columbia River at the point where Bradford Island divides it into two channels. In the main channel at the left work has begun on the cofferdam to shut off half the river. In the center is Bradford Island, and beyond it the back channel has been shut off by cofferdams, and excavation for the power house is in progress.

of steel siphon and 61 miles of canal with a 13,700-sec.-ft. capacity. Power was to be developed at a number of drops in the canal. These features represented a general approximation of the plans of the several proponents.

In recent years the original plan for a gravity system for water delivery has given way to the pumping plan. This latter has the great advantage of avoiding enormous initial investment in large structures whose full capacity would not be required until all the land was under development.

The pumping project contemplates a dam across the main channel of the Columbia River near the upper end of the Grand Coulee, where head can be developed for power to be used in pumping water into a storage reservoir to be formed by building a dike across each end of the deep valley known as the Grand Coulee. From this reservoir canals will supply the irrigable areas.

THE COLUMBIA BASIN irrigation project, if developed by pumping from the river at the site of the dam now under construction, would be comprised of the reservoirs, canals and irrigated areas here shown.


GRAND COULEE DAM
(Under construction)
Pump house and pipe line
COLUMBIA R.
Construction railway to dam
North Dike
GRAND COULEE RESERVOIR
South Dike
N.P. Ry.
Odair
Explanation
Irrigable areas under pumping
Irrigable areas under supplemental pumping (100 foot limit)
Non irrigable areas
Siphons
Tunnels
Canals and laterals
0 5 10 15 20
Scale of Miles
WEST CANAL
MAIN
Adrian
Ephrata
Quincy
G.N. Ry.
MAIN
MOSES LAKE
THE POTHOLES
EAST
CANAL
Lind
FRENCHMAN HILLS
C.M.&St.P.R.R.
COLUMBIA RIVER
Connell
N.P. R.R.
SNAKE RIVER
S.P.&S.R.R.
Pasco
LOCATION MAP
LAKE CHELAN
GRAND COULEE RES.
COLUMBIA R.
Seattle
Adrian
Spokane
Olympia
Wenatchee
Pasco
Lind
SNAKE R.
COLUMBIA RIVER
PACIFIC OCEAN
Portland

Although the total area susceptible to irrigation is 1,200,000 acres, it is not contemplated that all this would be developed at one time. For example, it has been suggested that the first unit would be a tract of about 125,000 acres near Quincy.

The lands which it is proposed to irrigate under the Columbia Basin project are shown in the accompanying map.

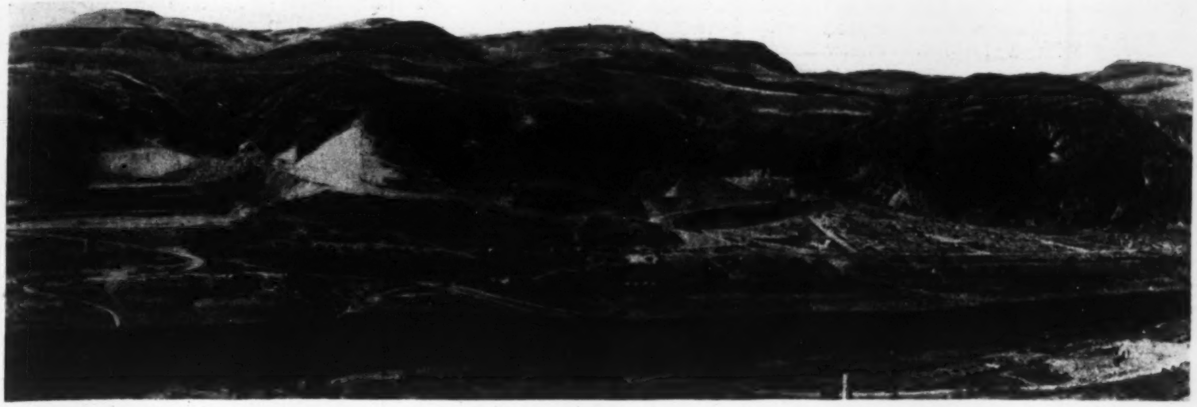
The lands are arid, with precipitation of 4 to 10 in., and are said to be the bottom of an ancient lake covering all of central Washington.

The region originally was covered with grass and sagebrush. Attempts have been made to develop it by dry farming, but practically all of the dry farms have been abandoned.

The army engineers' report quoted Elwood Mead, Commissioner of Reclamation, as believing that there was not then (1932) an immediate need for the farms of the irrigable areas which it was proposed to develop in the Columbia Basin, nor yet for the crops to be grown upon them. Since then the picture has been changed materially, and under date of Oct. 23, 1934, a letter from Dr. Mead to Senator Dill says, in part:

> Much attention has been given to the development of the Columbia Basin project during the past two or three months. This is because of a continued recognition of how much more valuable this development would be if we returned to the original conception of a high dam and the irrigation of 1,200,000 acres of land.
>
> Many things have occurred in the last eight months to change the economic situation existing when the low dam and the power development was adopted. The drought of last year, the purchase of several million acres of marginal lands, the migration of large numbers of people toward the West in the hope of securing homes there because that has always been the frontier, has created a situation that makes the irrigation development of the Columbia Basin land as desirable now as it was doubtful a year ago.
>
> As I write this I am considering an appeal from the state of Idaho that we do something to provide homes for more than a thousand families that have come into Idaho recently from the East, driven off their former farms by drought and seeking an irrigated farm in the West. The reports from the state of Washington are that the state is confronted with the problem of supporting a large increase of population due to the migration from the drought-stricken farms of the semi-arid states.
>
> There is no place in this country which surpasses the Columbia Basin area in the attractiveness of its climate, the fertility of its soil, the certainty of its water supply and the ability of man to make a comfortable living on a small area of land. If we revise this project (to the high dam plan) now, we can in that revision provide for speeding up the rate of construction, and we can provide employment for a large number of workers by making the construction of the canals and laterals and the preparation of the ground for irrigation a part of the development. I know of no place where more workers can be employed on a self-liquidating scheme of development than could be provided on the Columbia Basin project under this revised scheme.

The climate in the basin is rated as slightly better than that of the irrigated sections of the Yakima Valley, assuring a somewhat longer season. Five-sixths of the land is in private ownership; of the remainder, the state, nation and railways own about 5 per cent each. Land values range from $5 per acre for



THE GRAND COULEE DAM will have its west abutment against the bank at the left where excavation is shown in progress. Farther downstream, near the right of the picture, is the permanent townsite. The contractor's camp is on the slope in the right foreground.

grazing and dry-farming wheatland up to $20 or more per acre. Water requirements, as estimated differently by different investigators, range from 32 to about 40 in. Roughly, the project area is about 80 miles east and west and the same distance north and south.

Grand Coulee Dam

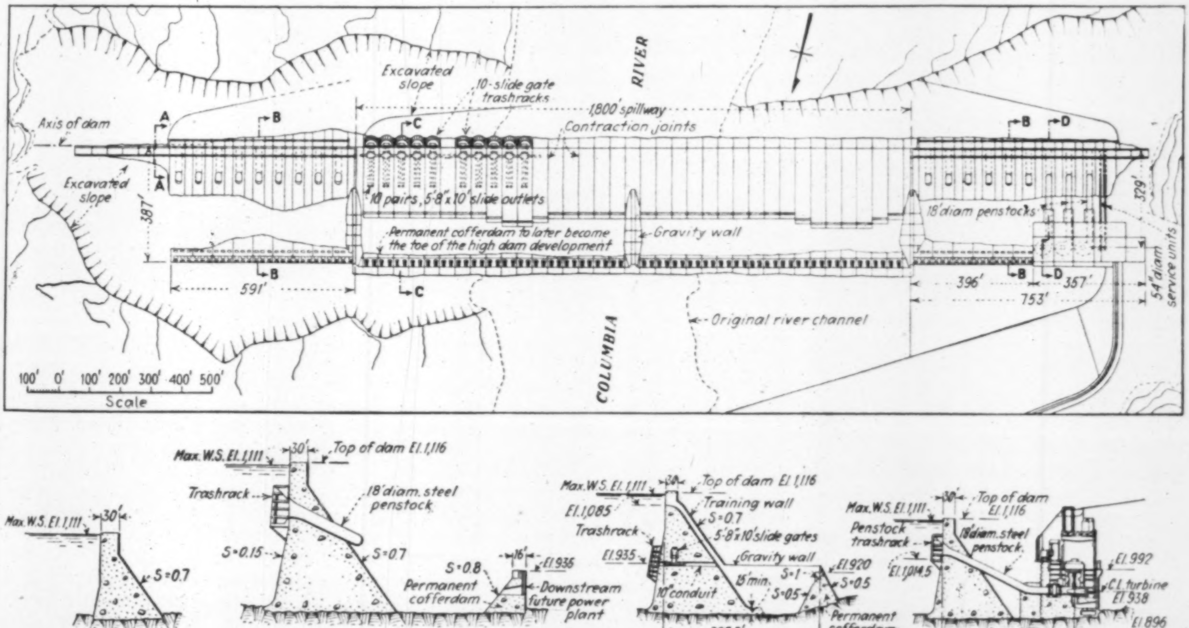
FOR MANY YEARS the proposal to build a dam at Grand Coulee on the Columbia River has been closely associated with the proposed Columbia Basin irrigation project. The present program calls only for construction of a low dam (145 ft. high) with provisions for developing about 103,000 kw. of power initially and about 617,000 kw. ultimately. The low dam, however, will include the lower part of the power house and the foundation for the high dam (475 ft.), which may be used as the diversion dam and power source for the Columbia Basin project. All of the low dam is to be used in the high dam later.

Inclusion of irrigation features as an integral part of the present low-dam construction would not be feasible because the pumping head would be excessive. Even from the normal pool level of the high dam a 300-ft. pumping lift will be required to raise water into the Grand Coulee.

The low-dam project was begun last year under a PWA allotment of $63,000,000 made originally to the Columbia Basin Commission, a state body, but subsequently transferred to the U. S. Bureau of Reclamation, thus making the project a federal undertaking, apparently because of the inability of the state commission to put up the security that the PWA requires for state and municipal loans. Construction is under the direction of the engineers of the bureau, and the marketing of power likewise is expected to be in the hands of the Secretary of the Interior (See *ENR*, Aug. 3, 1933, p. 145).

The low-dam project is to start out with a three-unit section of the west power house of the high dam, plus two service units. The equipment to be installed for low-dam service will be the

A GENERAL PLAN and typical sections of the Grand Coulee Dam. The low dam is being built in a manner calculated to facilitate construction of the high dam at a later date. The river flows almost due north at the dam site.


Excavated slope
10-slide gate trashracks
RIVER
Axis of dam
A
B
C
1,800' spillway
Contraction joints
B
D
Excavated slope
387'
10 pairs, 5'8" x 10' slide outlets
18' diam penstocks
329'
Permanent cofferdam to later become the toe of the high dam development
Gravity wall
B
591'
C
396'
B
D
357'
753'
54" diam service units
Original river channel
COLUMBIA
100' 0' 100' 200' 300' 400' 500'
Scale
Max. W.S. El. 1,111
30'
S=0.7
Section A-A
Max. W.S. El. 1,111
30'
Top of dam El. 1,116
Trashrack
18' diam. steel penstock
S=0.15
S=0.7
S=0.8
16'
El. 936
Permanent cofferdam
Downstream future power plant
Section B-B
Max. W.S. El. 1,111
30'
Top of dam El. 1,116
El. 1,085
Training wall
S=0.7
Trashrack
5'8" x 10' slide gates
El. 935
Gravity wall
El. 920
S=1
15' min.
S=0.5
S=0.5
10' conduit
399.8'
Permanent cofferdam; toe of high dam
Spillway Section C-C
Max. W.S. El. 1,111
30'
Top of dam El. 1,116
Penstock trashrack
18' diam. steel penstock
El. 1,014.5
El. 992
C.L. turbine El. 938
El. 896
329'
Power Plant Section D-D

units designed for the high dam except that each turbine will be equipped temporarily with a low-head runner developing 34,300 kw. In the ultimate development of the low-dam power house the total installation is to be 617,400 kw.

Work on construction of the low dam has been in progress since January, 1934, and the contract calls for its completion in July, 1938. This structure involves about one-third the total volume of the high dam, is a straight gravity dam 3,500 ft. long, 300 ft. high above lowest foundation, requires some 15,000,000 cu.yd. of excavation and will contain about 3,500,000 cu.yd. of concrete.

The army engineers' report on the ultimate development at Grand Coulee estimated $168,366,000 for the high dam and power plant and $208,265,000 for the irrigation development (a total of $376,631,000). Proponents of the Columbia Basin irrigation project, however, assert that a plan of development can be followed which would cost the government only $160,000,000 for the high dam and power plant. From this point forward, they hold, revenue from the sale of power would provide ready cash for such development costs as would be required to bring the land under irrigation, one block at a time, as rapidly as there were settlers to occupy and farm it.

On this basis it is expected that the profits from the sale of power will return the investment in the dam and power plant and 50 per cent of the cost of the irrigation improvements. The remainder of the irrigation cost is to be repaid by landowners at $2 per acre per year for four years and then $2.50 per acre per year for 32 years, a total of $88 development cost repaid by landowners. Operation and maintenance are to cost $3.20 per acre per year, making a total payment by irrigators of $5.70 per acre per year.

When the high dam is built, the power house to accompany it will have space for an ultimate installation of two banks of nine units, each unit developing 105,000 kw., plus two 6,000-kw. service units, a total of 1,900,000 kw. The requirements for pumping irrigation water are expected to be about 2,260 million kw.-hr. per annum (when the entire 1,200,000 acres are under cultivation), leaving 7,013 million kw.-hr. per annum firm power and 1,910 million kw.-hr. secondary power for sale. In other words, out of a total of 2,000,000 hp., one-half primary and one-half secondary, the pumping load will amount to about 600,000 hp., which can be taken from the secondary power classification.

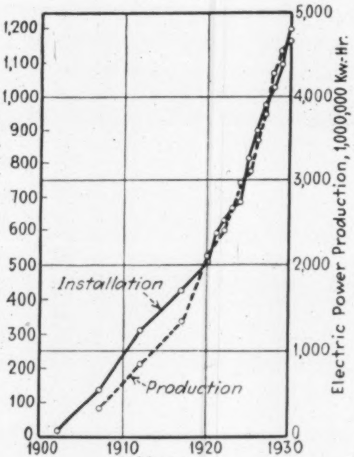
The pumping plant to lift water into the Grand Coulee is to have a capacity of 16,000 sec.-ft. and is to be located upstream of the west abutment of the dam. It will contain 20 single-stage units with a capacity of 800 sec.-ft. under a 370-ft. head. The head will vary from 280 to 360 ft. net.

Four and a half years are allowed in the contract for construction of the low dam. If the high dam is built, it is expected to require five or six years.

Irrigation, if developed in proportion to settlement and if the land is occupied at the rate of 20,000 acres per year, is estimated to require 60 years to bring the entire area under irrigation. This indicates the magnitude of the undertaking and the long-range element in the planning, particularly in the matter of bringing additional land under settlement and cultivation.

Power Situation in the Northwest

ENERGY CONSUMPTION in the three Northwest states in 1930, the maximum year, was 4,686,182,000 kw.-hr. Since then it has dropped approximately 10 per cent. In 1930 the installed capacity of the power plants totaled 1,272,780 kw. This capacity has been increased to 1,481,535 kw. during the past four years by the completion of the Rock Island, Ariel and other private utility plants that were under construction at the beginning of the depression. Power capacity at the present time is capable of producing six billion kilowatt-hour annually at the 47 per cent capacity factor that prevailed in 1930. In other words, generating facilities now installed in the Northwest are capable of producing 50 per cent more power than was required in 1933. Nor do these figures include the 120,000 kw. now being installed in the Diablo plant of the city of Seattle, which will increase the margin between the demand and capacity proportionately.



GROWTH of electric-power installation and production in Washington, Oregon and Idaho.

Briefly then, the present market of four billion kw.-hr., in the Northwest represents only two-thirds of the potential output of the plants now installed within transmission distance of load centers. To the six billion kw.-hr. capacity of the present installations the initial power installations at Bonneville and Grand Coulee (190,000 kw.) will add another billion on the basis of the 47 per cent capacity factor of 1930, and the additions now being made to the Diablo plant of the Skagit River system of the city of Seattle will bring in a somewhat lesser amount. Thus about 1½ billion kw.-hr. is to be added to a market that already has an excess of 50 per cent over present requirements. The ultimate installations proposed for Grand Coulee and Bonneville will add roughly a potential output of 9 billion kw.-hr., making a grand total of 15 billion kw.-hr. of generating capacity to supply a market which in its maximum year used barely 25 per cent of that amount.

For the purpose of visualizing these relationships, the accompanying chart, p. 685, was prepared. The lower curve represents the actual power used by consumers in the Northwest for the years 1929-33 and is projected on to 1950 at a rate of growth of 5 per cent per annum. Just when and at what rate electric consumption will resume the upward trend is a debatable question, but for the purposes of this discussion it is assumed to start in 1935. The first power from Bonneville and Grand Coulee will be available about 1938.

No attempt has been made to draw in a curve showing total installed capacity in the next decade or two because the rate at which the units will be installed in the new plants is wholly a matter of conjecture at this time.

Because of low rates and aggressive expansion policies, only a small percentage of the total population of these three states is without electric service. Increased domestic usage therefore will have to come from population growth and greater utilization of energy by present consumers. Complete home electrification in the Northwest has the better prospect there because cheap natural-gas competition as yet has not entered the house-heating market, and because mild climatic conditions on the Pacific slope are conducive to electric heating.

To what extent new developments, increased usage and utilization, population growth and industrial recovery will absorb the surplus power to be made available by the new federal projects on the Columbia cannot be predicted, as the rate of power consumption by industries in the Northwest has considerably exceeded the national average.

A resumption of building on a national scale would aid materially in stimulating consumption in lumber mills and metal-producing operations.

Power markets and rates

The major questions before all those interested in the Bonneville and Grand Coulee projects—and this includes the private utilities of the region as well as government officials, are: (1) what rates shall be charged for this power; and (2) what markets can be developed to use it.

D. C. Henny, who is serving as consulting engineer on all the western federal power projects, proposes that the basis for fixing a power rate on each of the government's projects should be the objective of getting maximum beneficial use of power at the earliest possible date. This objective might mean an extremely low rate. Where that would be so, he points out, it would be better to allow the low rate than to permit the plant to stand idle and lose the benefits that would be certain to follow beneficial use.

Mr. Henny goes further in his recommendations and points out that low power cost is only one of numerous factors that an industry must consider in building a plant in new territory. Taxes, low rental costs and low freight rates are among the items on which a new industry might be helped if state and national agencies were disposed to encourage their entry into the new field. Ocean freight rates to the Eastern seaboard also might be a factor in the choice of location for certain industrial plants. It is conceivable, Mr. Henny suggests, that the most effective way to secure an equable distribution of load at the various plants that the government is now developing throughout the country would be to establish rates that would to some extent compensate for this cost of reaching the market for the product.

The present average for domestic consumers in the Northwest is about 1,165 kw.-hr. per year, or about double the average for the United States as a whole. Further increases in this already high rate of consumption must take into account the limit on the amount the consumer can spend for the necessary electrical appliances.

In estimates presented at a recent committee meeting of the water resources committee of the Northwest Regional Planning Conference, a 25-year period of development was assumed as a basis, and it was estimated that in this time, with a reasonable extension of industrial and irrigation demand, the requirement might reach the following figures:

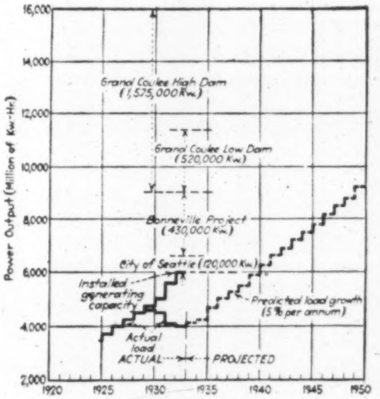
	Kw.-Hr. Per Annum
Columbia and Willamette River areas	1,000,000,000
Puget Sound area	1,500,000,000
Eastern Washington and Northern Idaho	500,000,000
Total	3,000,000,000

To this total could be added another 1½ billion kw.-hr. per annum for irrigation pumping on the Columbia Basin project and other irrigable areas of the Columbia River valley if irrigation is extended on a fairly rapid scale during the 25-year period.

The heavy power-consuming industries to which particular study is being given are those dealing with aluminum, nitrogen and phosphate compounds, newsprint and ferro-alloys.

Competition for markets

Private power companies have frankly stated that they cannot compete with the low rate at which Bonneville power doubtless can be offered to heavy power-consuming industries. Not quite the same is said of low-cost municipal power from the vicinity of Puget Sound. In the Portland district, at least, it is the current belief that the power from Seattle and Tacoma municipal plants will make aggressive bids for the low-rate power consumers that might be interested in Bonneville power. Since the completion of Seattle's Diablo Dam large additional blocks of power can be developed in the Diablo and Gorge plants. Seattle now is installing two 60,000-kw. units expected to be ready for service by 1936, and the proposed ultimate installation is 840,000 kw.



PRESENT and prospective power conditions in Washington, Oregon and Idaho.

Industrial power studies

Numerous agencies, public and private, are at work in the Northwest in the endeavor to develop potential industrial markets for low-cost power. One of these agencies is the Pacific Northwest Regional Planning Commission, which is affiliated with the National Water Resources Board. The power subcommittee of this planning commission is holding frequent meetings at one of which, held in Spokane, Nov. 1, plans were laid for further activities and the coordination of studies now under way. Some of the investigations stated at the meeting to be under way are those of: (1) the state committee on the relation of electricity to agriculture, headed by the heads of the agricultural engineering departments of the land grant schools in the area; (2) a committee on domestic applications under the chairmanship of P. B. McKee, president of the Northwestern Electric Co. of Portland; (3) an electric heating committee under the chairmanship of H. V. Carpenter, Washington State College, which will study both residence heating and electric-furnace possibilities; (4) experimental work under J. D. Ross, superintendent, Seattle Municipal Light Dept., on reversed refrigeration and heating, which will be carried out this winter; (5) electro-chemical studies under the direction of W. A. Bradt, Washington State College; (6) uses of electricity in the pulp and paper industries by the Bonneville Power Commission (a body appointed by the state of Oregon late in 1933 to study and report on prospective markets, rates and desirable legislation concerning Bonneville power generally); (7) a study of the production of chromium from Montana areas by Dean Cobleigh of Montana State College; (8) experimental work on the production of aluminum and magnesium by A. E. Drucker, Washington State College; (9) a study of phosphates from Northwest resources by R. W. Gelbach, Washington State College; (10) investigation of aluminum manufacturing under the chairmanship of W. D. Dodson of Portland; and (11) a study of irrigation pumping load, C. A. Mockmore, Oregon State College, chairman.

The cooperation in these studies of the privately owned utility companies indicates a willingness to aid in developing a power market outside their own range of service, but one that doubtless would benefit the community as a whole. In this cooperation the private power companies express the hope that a non-competitive policy will be adopted by the government in the management and sales policies of the federal plants.

Employment

As both the Bonneville and Grand Coulee dams were authorized in order to create a large amount of employment quickly, it is of interest to note the results to date. The Grand Coulee allotment was made in August, 1933, but was delayed by legal questions, with the result that work did not get under way until in the late fall. By Jan. 1 of this year there were 326 men on the job, and by the first of November the number had increased to 1,700. Employment is expected to increase rapidly now as the contract for the dam is under way.

At Bonneville the contractors' and government forces totaled 400 at the first of the year, 1,300 in July, and 2,750 at the first of November.

The Boulder Canyon Project a Fully-Planned Development

Started long before the New Deal, the Boulder Canyon project differs from recent federal undertakings in that power contracts whose revenue is to repay all costs plus interest were made prerequisite to appropriations—Recent developments affect market for power

THE BOULDER CANYON project enjoys unique distinction among the large construction ventures which the federal government now has under way, because it started with a fully programmed future and a balanced budget. At least advance contracts were made to assure repayment of government expenditure plus interest. The purposes of the undertaking, as stated in the Boulder Canyon Project Act (H. R. 5773), the legal structure on which the work is based, are: (1) "Controlling the floods, improving navigation and regulating the flow of the Colorado River, (2) providing for storage and for the delivery of the stored waters thereof for reclamation of public lands and other beneficial uses exclusively within the United States; and (3) for the generation of electrical energy as a means of making the project herein authorized a self-supporting and financially solvent undertaking."

In working toward these objectives this project has the important advantage of a long and successful preparatory period, during which preliminary study (and controversy) finally resulted in a very definite construction program with water and power allocations agreed to by most of the conflicting interests, limitations determined by court decrees, and power rates fixed in exact detail by contracts. The more essential of these activities were prescribed by acts of Congress. Altogether there has been ample opportunity to iron out objectionable features, or at least to air them fully and, if need be, to overrule a minority. (The Colorado River compact finally was adopted and put into effect with the approval of six states after Arizona's refusal to sign.)

On the Boulder Canyon project today, the dam is nearing completion, the power houses and the penstocks are well advanced, and in addition the first contract has been let on the All-American Canal to deliver irrigation water stored behind the dam to the Imperial Valley, most of the contracts for the aqueduct to deliver water to the Metropolitan Water District of Southern California have been let, and the electric transmission lines are under construction. The aqueduct and transmission lines are not federal undertakings.

Contract for the construction of Parker Dam, about 150 miles below Boulder Dam, an essential element in the aqueduct system of the Metropolitan Water District, was let in August. Originally it was expected that the dam would be built by the district, but it is now being built by the federal government through the Bureau of Reclamation in order to avoid a conflict between the states of California and Arizona over construction of the dam by the district.

Boulder Dam Chronology

Nov. 24, 1922—Colorado River Compact signed at Santa Fe, N. M., by Herbert Hoover representing the federal government. This paved the way for federal aid.

Dec. 21, 1928—Enactment by Congress of Boulder Canyon Project Act (H.R. 5773). Fourth version of the bill first introduced in 1922.

June 25, 1929—President Hoover declared Colorado River Compact in effect and Boulder Canyon Project Act effective.

Oct. 1, 1929—Bids opened on Boulder power contracts.

Apr.-May, 1930—Contracts signed for delivering water and power to Metropolitan Water District, Southern California Edison Co., City of Los Angeles and other companies and cities.

July 3, 1930—Congress passed bill appropriating $10,660,000 to start work at Boulder Dam.

March 11, 1931—Contract signed with Six Companies, Inc., for construction of Boulder Dam. Contract price, $48,890,995.

No federal funds were made available for the Boulder Canyon project until contracts had been signed for the sale of power that would insure repayment of all federal expenditures (a total of $165,000,000, including $38,500,000 for the All-American Canal), with 4 per cent interest in less than 50 years. Moreover, these stipulations were accompanied by a program, worked out in great detail, for allocating to the several states or to other agencies the water, power and revenue that the project would make available. Careful provision, even, was made for the allocation of revenues from power if there should be any over and above that required for repayment of costs. Even those who hold that this expenditure of government funds is not justified—and such there are—agree that the program is complete and has been worked out in great detail.

Despite these distinct differences from projects undertaken by the federal government on short notice as part of the "New Deal" program, the Boulder Canyon project must be included when studying federal ventures in construction, because the power generated at Boulder Dam brings this undertaking into the same class with the other "yardsticks" the President has desired to set up in several parts of the country, so that by them "The nation could judge of the equity of electric rates charged by private utilities." In the following are set forth elements of the Boulder Canyon project which bear on its economic aspects, together with a summary of the recent developments related to the undertaking, which indicates the current trend of its prospect for ultimate success.

Need for a Colorado River dam

Ever since irrigators along the lower reaches of the Colorado River began to use the turbulent waters of this stream, their activities have been plagued by floods and by the excessively heavy silt content. The Imperial Valley, separated from Mexico by the Colorado River, was a fertile field for American enterprise, and nearly a half million acres of land have been brought under cultivation there since the old California Development Co. set the example for large-scale irrigation in this country about the first of the century. Later, when the landholders on this project reorganized as the Imperial Irrigation District under California irrigation law, important progress toward solving flood and silt problems was made because from that point onward state and federal authorities were drawn into the solution of these problems.

Urgent as was their need, Imperial Valley lands could not afford to pay for a structure to hold back the destructive floods of the Colorado River and use the waters to replenish the flow in seasons of low water. Ultimately federal aid might have come to the irrigators alone, but meantime two factors entirely independent of irrigation entered the picture.

One of these, caused by the steadily lowering water table in the coastal plane adjoining Los Angeles, was the anxious desire of citizens in that rapidly growing community to secure an adequate water supply for the greatly increased municipal demands predicted for the future. The other was the possibility of lucrative water-power development that would be a byproduct of water stored behind a Colorado River dam. Power could be developed economically only if the dam were located at a point where a considerable head would be developed by the falling water.

More than ten years ago it became apparent that the Colorado River would be the battleground of conflicting interests in development of the natural resources there available. Early endeavor was made to get conflicting interests together on common ground. Witness the long series of conferences held in the endeavor to adopt a "seven-state compact" or Colorado River compact in which the several states involved, it was hoped, would agree on terms and conditions of development, control and use of the Colorado River. Arizona was not receptive to the program that the other six states wanted to adopt.

When the other six states signed the Colorado River compact in 1922, Arizona began a fight to prevent consummation of the development plans the others proposed. This was not finally settled until the case of Arizona vs. California *et al.* was dismissed by the Supreme Court of the United States in May, 1931.

During all the intervening years, however, interests in California were most active in attempting to get federal sanction for a plan of development that would conserve natural resources going to waste on the Colorado River. This was slow work. Although the first Boulder Canyon Project Act was introduced in Congress in 1922, it was not until Dec. 21, 1928, that the fourth version of this bill finally was passed by Congress. Part of this delay, of course, was caused by the many ramifications of the project as a whole and the various possibilities involved.

The Colorado River Basin

The Colorado River Basin comprises some 240,000 square miles and is divided into two parts by the narrow 400-mile gorge whose northern end is at Lee's Ferry, Ariz. Above this constriction lies the "upper basin" in Colorado, New Mexico, Utah and Wyoming. Downstream lies the "lower basin" in Arizona, California and Nevada. Although the upper and lower basins have about the same area, the irrigable areas are not so divided, the lower basin having about 2,127,000 acres and the upper basin 4,000,000 acres. A storage dam in the lower reaches of the stream would be of no benefit to upper-basin areas, and to store waters in the upper basin would not afford protection for areas lower down from the tributaries entering the Colorado below the dam. Some of these lower tributaries are responsible for the most serious flood menace in Imperial Valley.

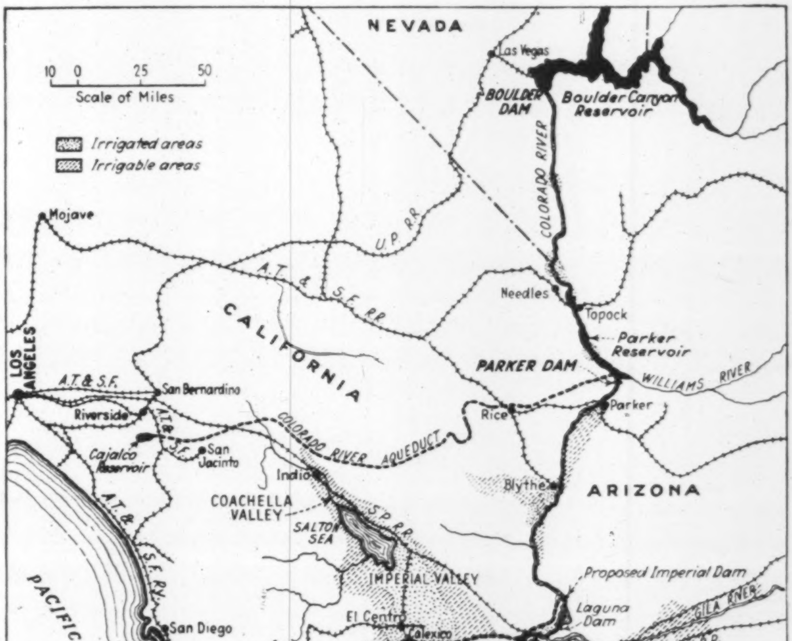
Many development plans studied

Studies of the Colorado River Basin to determine the relative merit of plans for dams at different locations have been numerous and extensive. Each of these plans had to be considered in its entirety. By considering as one "plan" a combination of structures throughout the full length of the stream, this could be compared with other "plans" in terms of total available storage, power, evaporation loss, effectiveness in flood and silt control, distance from power markets and other factors. As early as 1924 the Bureau of Reclamation had compiled a very elaborate study of eight complete plans for the development of the Colorado.

The expectation is that more storage and power dams will be built later on the Colorado. With the adoption of the Boulder Canyon Project Act there was commitment to the first unit in a plan which left open for later decision all of the numerous sites in upper and lower basins. The act, too, has settled the question of water allocations between upper and lower-basin states.

Whether or not Boulder Dam is in the best location for the first unit of development, it does serve the lower-basin states in the control of floods from the upper-basin territory, and it develops an excellent power site whose revenues are expected to repay the entire cost of the present project. Printed transcripts of the hearings before Congressional committees on various phases of this and other plans that were debated before the Boulder Canyon Project Act was approved, occupy several feet of shelf space.

Obviously, no one dam could meet the requirements of storage, flood control and power development. To avoid controversy or risk of future misunderstanding, the paramount claim of irrigation uses was set up clearly and definitely at the outset, and federal operation of the reservoir was stipulated.



NEVADA
10 0 25 50
Scale of Miles
Irrigated areas
Irrigable areas
Las Vegas
BOULDER DAM
Boulder Canyon Reservoir
COLORADO RIVER
Mojave
U.P. R.R.
A.T. & S.F. R.R.
Needles
Topock
CALIFORNIA
Parker Reservoir
PARKER DAM
WILLIAMS RIVER
LOS ANGELES
A.T.& S.F.
San Bernardino
Riverside
Rice
Parker
COLORADO RIVER AQUEDUCT
Cajalco Reservoir
San Jacinto
Indio
Blythe
ARIZONA
COACHELLA VALLEY
SALTON SEA
S.P. R.R.
A.T. & S.F. RY.
IMPERIAL VALLEY
Proposed Imperial Dam
Laguna Dam
GILA RIVER
PACIFIC OCEAN
San Diego
El Centro
Calexico
Yuma
S.P. R.R.
ALL AMERICAN CANAL
Yuma project
PRESENT CANAL TO IMPERIAL VALLEY
UNITED STATES
MEXICO
LOWER CALIFORNIA
GULF OF CALIFORNIA

BOULDER DAM will supply irrigation water to the Imperial and Coachella valleys and both power and water to the metropolitan district surrounding Los Angeles. Parker Dam, now under construction, forms a reservoir from which water is to be pumped into the Colorado River Aqueduct. Nearer the international border, work has been begun on the All-American Canal to replace the canal that now runs through Mexico to supply the irrigation system in the Imperial Valley.

Although it is power that is financing the project, it is agreed that power is to be a byproduct; water never is to be stored purely for power development. Moreover, the upper 9,500,000 acre-ft. of reservoir capacity (total capacity 30,500,000 acre-ft.) is to be reserved for storing the peaks of flood runoff from the upper basin, and the operating policy will be to keep this capactiy in reserve toward the flood season so as to be available for this purpose.

Hydrology

The Colorado River compact was signed at a time when it was believed that the average annual flow of the Colorado was 18,000,000 acre-ft., and allocation of the waters was made on that basis. Of this total the right to "beneficial consumptive use" of 7,500,000 acre-ft. was assigned to the upper-basin states and 8,500,000 acre-ft. to the lower-basin states; the remaining 2,000,000 acre-ft. was left without allocation—possibly with the thought of needing it to meet Mexican claims.

In 32 years of actual records (gage heights cover a longer period) the minimum flow at Yuma was about 7,000,000 acre-ft., and the maximum flow 25,000,000 acre-ft. This year (1934) the total runoff at Boulder for the nine months prior to Oct. 1 was 3,719,000 acre-ft.

All public lands in areas below Boulder Dam have been withdrawn from entry and will not be reopened until after areas brought in by the All-American Canal have been opened and the demand for such lands studied and observed. This is expected to require at least four years. Until there are more data on the trend of flow in the present low-water period, withdrawal of public lands is meeting with popular approval.

Of the annual water crop allocated to the lower-basin states, California has agreed to accept 4,400,000 acre-ft. as its share, although it may use in any year one-half the surplus water available above the quantity allocated to the lower-basin states. The Boulder Canyon Project Act authorizes an agreement (not yet made) whereby Nevada would get 300,000 acre-ft. and Arizona 2,800,000 acre-ft. of the available waters "for beneficial consumptive use."

Of the California allocation all water that is to be available has been assigned to the Metropolitan Water District and to the several irrigation districts. The only actual payment for water is the 25c. per acre-foot which the Metropolitan Water District is to pay. When full allotment is taken, this will amount to about $250,000 per annum.

The storage capacity in Boulder Reservoir will be 30,500,000 acre-ft. Of this total 5,000,000 to 8,000,000 acre-ft. has been set aside as a silt pocket, 12,000,000 to 15,000,000 acre-ft. is considered active or regulation storage, and 9,500,000 acre-ft. in the upper portion of the reservoir is to be reserved at certain seasons for flood control. No storage is allotted for water to be used for power generation. Power is to be wholly a byproduct and is to be manufactured only when water is being drawn from the reservoir for other purposes. Evaporation from the reservoir is estimated at 5 ft. per annum, a relatively low figure because the average depth will be great.

Financing of the Boulder Canyon Project

Allocation of the $165,000,000 authorized by the Boulder Canyon Project Act is as follows:

Dam and reservoir	**$70,600,000**
Power plant	**38,200,000**
All-American Canal	**38,500,000**
Interest charges	**17,700,000**
Total	**$165,000,000**

Appropriations to date have been as follows:

1930-31	**$10,660,000**
1931-32	**15,000,000**
1932-33	**23,000,000**
1933-34	**46,000,000**

The maximum flood actually measured in the 32-year period of flow measurement was 208,000 sec.-ft. at the Boulder site. The flood of 1884 (not measured) is estimated from gage readings to have been about 384,000 sec.-ft. The two Boulder Dam spillways will have a combined capacity of 400,000 sec.-ft., and the bypass valves and penstocks will total 125,000 sec.-ft. more. Operation of the reservoir is expected to be such that any ordinary flood will be regulated by the dam to about 45,000 sec.-ft., and in the case of extreme flow, such as 200,000 sec.-ft., even when prolonged for some time, the effect of the reservoir would be to reduce this to a 75,000-sec.-ft. flow. Sharp peak floods of 200,000 sec.-ft. can be absorbed by the reservoir without effect on the river below if the reservoir stage was not too high. Thus, so far as menace to irrigated lands below from the upper-basin states is concerned, Boulder Dam should relieve them entirely from flood menace. The Williams River, entering the Colorado just above Parker Dam, sometimes flows as much as 60,000 or 70,000 sec.-ft. for short periods; the Gila River, which joins the Colorado just above the Yuma and Imperial irrigated lands and which always will be a flood menace to these areas, formerly had floodflows of 200,000 sec.-ft. for short periods. Recent changes, including the construction of Coolidge Dam, have reduced this flood menace to about 100,000 sec.-ft. Boulder Dam, therefore, will not remove from Imperial Valley the necessity for maintaining levees along the Colorado and keeping the channel clear for floods that may come down from the Gila and the Williams rivers.

All-American Canal

A MAIN CANAL entirely on American territory has been the goal of Imperial Valley irrigationists ever since the first disputes with Mexico arose over the 50 miles of canal that now detour through Mexican territory on its way from an intake within the United States to water American lands. Effort to secure federal aid for an All-American Canal has been made more or less continually since the Kettner Bill, proposing such a project, was introduced in Congress in 1919.

When the Boulder Canyon Project Act was drafted, the All-American Canal was included as an essential part of that undertaking and was allotted $38,500,000 out of the $165,000,000 appropriated. Provision is made for a main canal from the Colorado River to the Imperial and Coachella valleys via a route entirely within United States territory; provision also is made for the city of San Diego to obtain 155 sec.-ft. of water from this canal when the stipulated contract arrangement is made between the government and that city.

As in the case of Boulder Dam, construction work will be done under the direction of the Bureau of Reclamation, and the plan is that the entire cost of the work will be repaid to the government by the water users in conformity with the terms of contracts under which the water is to be delivered. The contract with the Imperial Irrigation District was signed on Dec. 1, 1932; contracts with the Coachella Valley County Water District and with the city of San Diego were under consideration as this was being written. The terms of the contract are expected to reimburse the government in a period of 40 years for actual expenditures on construction (without interest), and there is to be no

POWER REQUIREMENTS: COLORADO RIVER AQUEDUCT PUMPING PLANTS

Pumping Plant Location	Distance from Colorado River (Miles)	Static Head (Ft.)	Pump Discharge El. Above Sea Level (Ft.)	*(Ultimate) Power for 1,500 Sec.-Ft. (Kw.)	(Initial) Power for 432 Sec.-Ft. (Kw.)
Intake	0	290	740	48,000	13,800
Gene Wash	2	302	1,036	50,400	14,500
Iron Mt	67	147	1,047	24,800	7,100
Eagle Mt	105	438	1,404	72,000	20,700
Hayfield	125	440	1,807	73,600	21,200
Totals		1,617		268,800	77,300

*This represents maximum power required at pump motors (motor output). Add 10 per cent for power required at Boulder Dam.

charge for the use, storage or delivery of water for either irrigation or potable purposes. Details of the All-American Canal project were published in *ENR*, Oct. 18, 1934, p. 488.

Navigation

Although navigation on the lower Colorado is specifically mentioned in the Boulder Canyon Project Act, and while it is true that after regulation by Boulder Dam the expected 12,000-sec.-ft. minimum in the lower reaches of the stream would be ample for the navigation of small craft in the lower river, yet it is not believed that navigation will play any important part in the development of commerce in this region.

Some of the factors supporting this belief are that the very considerable variation in level expected in the operation of Parker Dam will make for changes in the channel above. While it would be possible to put locks past this 85-ft. dam and another set at the diversion into the All-American Canal (about a 50-ft. lift at the diversion point), these improvements would be of benefit to navigation only between these two points. Below the All-American Canal all the water will be diverted from the river for a large part of the time, and in future perhaps all flow will pass through the All-American Canal. Moreover, with more storage dams for irrigation purposes and more extensive use of the Colorado River water, it is believed that it will be impossible under any circumstances to bring boats up from the Gulf of California, so that navigation is practically out of the picture in the Boulder Canyon project.

Doubtless the chief reason for including any reference to it in the Boulder Canyon Act was to give color to the rather dubious claim that the federal government is justified in undertaking the work because it will benefit navigation, the federal government being restricted by the Constitution to river work that is beneficial to interstate and foreign commerce.

All-American Canal

Construction started, June, 1934.
Main canal capacity, 15,155 sec.-ft.
Main canal:

Width at water surface	**232**	**ft.**
Width at bottom	**160**	**ft.**
Depth	**20.6**	**ft.**

Length, main canal, 80 miles.
Length, Coachella Valley branch, 130 miles.
Length, main canal, now under construction, 30 miles.
Total excavation, 65,000,000 to 70,000,000 cu.yd., of which only 3 per cent is rock.
Power plant capacity, Pilot Knob plant, 60,000 kw.
Total estimated cost, $38,500,000.
Total irrigable area, 1,000,000 acres.

BOULDER DAM looking downstream from the Nevada side. In the right foreground is the Nevada spillway, and at the upper left is the Arizona spillway. The two Arizona intake towers are clearly shown, but the Nevada towers can be less clearly seen against the dam at the lower center of the picture. The dam itself has risen considerably since this picture was taken about the middle of August.

Water-power development

Although Boulder Dam is intended primarily for safeguarding and promoting uses of the river water for other purposes, construction of the dam was made possible at the time it was undertaken because there was a market for the power that could be developed as a byproduct. The dam site selected is one at which effective use can be made of water in the generation of power.

The state of the power market when bids were opened on the power contracts is apparent from the fact that two bidders (the city of Los Angeles and the Southern California Edison Co.) each applied for all of the power that would be developed at Boulder Dam. Altogether, applications were received for more than three times the amount of power available.

The allocation of the energy available was undertaken by the Secretary of the Interior on the premise that "The project act required that the public interests be the governing factor and that the first requisite in protecting the public interests was to provide adequate security for the taxpayers' money." Although the dam stands on the border between Arizona and Nevada and these states were to be given an opportunity to use the power developed, neither of them was in a position to make a firm contract for use of the power. California applicants, on the other hand, were eager to get the power; hence, with the reservation for immediate use went largely to California, as shown in the accompanying table.

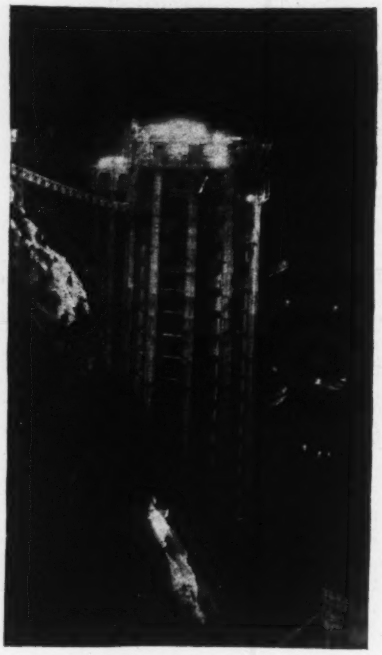
Precautions to protect irrigators from any reservoir control for the exclusive benefit of power development was provided by the stipulation that water could not be taken from the reservoir for power generation until stored water reached a total of 7,500,000 acre-ft., of which 3,500,000 acre-ft. was considered to be wholly a reserve for irrigation supply. The limitation in the other direction is the 9,500,000 acre-ft. of the reservoir capacity to be reserved for catching floods.

Estimates of the total firm power available set the figure at 4,240,000,000 kw.-hr. annually on completion of the dam, this amount to decrease with development of the storage sites upstream and the incidental consumptive use of water. The total continuous firm horsepower was estimated as 663,000 hp., based on 83 per cent plant efficiency and 10 per cent maximum storage available. At the present time contracts have been placed for two 82,500-kva. units and one 40,000-kva. unit. It is understood that the size of later units will be decided upon when the time comes for installation. The present intention, however, is that the capacity of the ultimate installation is to be 1,317,000 kva.

The policy in operation is to sell the rights to use falling water in the generation of power, and this is clearly stated in the contracts; the time, rate and total quantity of falling water delivered are to be entirely in the control of federal authorities, whose primary interest will be in operating the reservoir for the benefit of irrigation. Generating equipment in Boulder Dam power houses is being installed by the government. The purchasers of the power are to operate and maintain this equipment and to repay its cost plus 10 per cent in ten years.

On this basis the contract rate for firm power delivered at transmission voltage was 1.63 mills per kilowatt-hour, the purchaser to provide transmission facilities. Secondary or dump power was contracted for on the basis of 0.5 mills per kilowatt-hour at transmission voltage, these rates to be adjusted after fifteen years and every ten years thereafter.

The allocation of this power carries with it certain stipulations about transmission. The Southern California Edison Co. is appointed the agency for transmitting power to be used by other private companies, and the city of Los Angeles is to be the transmitting agency for power supplied to the smaller communities.



NIGHT WORK is a regular part of the program at Boulder Dam. Two of the 340-ft.-high intake towers are here shown.

The Metropolitan Water District will own the transmission lines over which energy is to be delivered at 220,000 volts for aqueduct pumping purposes. (Boulder Canyon power will have to be transmitted about 280 miles in order to reach the load centers of southern California.)

The excepted revenue from power sales, as of the first year of sale, is estimated to total $7,057,900 from primary power and $775,000 from secondary power. Although this rate of income is expected to decrease in later years the average over a 50-year period is estimated to be $7,200,000 per annum, or $361,000,000 for the 50-year period, this is an amount greatly exceeding the $165,000,000 appropriated for the project.

In analyzing revenue from power sales it is to be remembered that the full allotment of power may not be taken until the seventh year of operation. A development period or load-building period of four years was stipulated, and the utilities are not required to begin to take power until three years after the city of Los Angeles has begun to take its power. Hence, the full allotment may not be taken until the seventh year of operation, and the contract in each instance is for a period of 50 years, beginning with the date upon which the city of Los Angeles begins to take power.

The allocation of power income provides first for the repayment to the government of all costs of construction plus interest at 4 per cent. Thereafter, revenue in excess of operation and maintenance is to be allocated $18\frac{3}{4}$ per cent to Arizona, $18\frac{3}{4}$ per cent to Nevada and the remaining $62\frac{1}{2}$ per cent to the federal government. This latter is to be spent on flood control and further development of the Colorado River Basin as Congress may determine. If the estimated rates of power revenue are paid as expected, a total of $166,500,000 over costs would come in during the 50-year period, or $104,000,000 for the federal treasury and $31,200,000 each for Nevada and Arizona.

When the power contracts were made, the basis for beginning delivery was made to agree with the date required for completion of the construction contracts. Now it develops that completion of the dam is likely to be some two years earlier than was contemplated, and the question of power sale *ad interim* has come up.

Under the original contracts the Southern California Edison Co. was not to take its contracted power until 1938 or 1939, and then only 55 per cent in the first year. The Los Angeles Bureau of Power and Light, which is to take delivery when the power is ready, doubtless will compensate for the new power from Boulder by discontinuing the use of power which is at present being purchased from the Southern California Edison Co.

Low water raises new problem

A new angle to this prospective power situation has developed with the extremely low runoff of only 3,719,000 acre-ft. this year (nine months). This was scarcely sufficient for irrigation interests and, remembering that a total storage of 7,500,000 acre-ft. must be on hand (stored from *surplus* flow) before

BOULDER FIRM POWER ALLOCATIONS MADE IN 1929 FOR FIRST YEAR OF OPERATION

Organization	Allocation Per Cent	Kw.-Hr. per Annum
Metropolitan Water Dist...	36	1,526,400,000
Arizona	18	763,200,000
Nevada	18	763,200,000
City of Los Angeles	13	551,200,000
So. Calif. Edison Co.	9	381,600,000
Three small cities	6	254,400,000
Total	100	4,240,000,000

CHANGES IF ARIZONA AND NEVADA DO NOT TAKE POWER

Los Angeles plus Nevada	13 + 18	1,314,400,000
So. Calif. Edison plus Arizona	9 + 18	1,144,800,000

TOTAL ENERGY GENERATED IN NEVADA AND ARIZONA IN RECENT YEARS

State	Year	Kw.-Hr. per Annum	
Nevada...	1930	42,895,000	
	1931	19,006,000	—(Low water, bought Calif. power)
	1932	34,902,000	
	1933	21,963,000	
Arizona...	1930	384,443,000	
	1931	400,683,000	
	1932	267,561,000	(Copper mines closed)
	1933	296,824,000	

STATUS OF LOAD ON MAJOR POWER SYSTEMS OF SOUTHERN CALIFORNIA IN 1933

Generating Agency	Total Energy (Net) Generated in 1933, Kw.-Hr.	Total Installed Capacity—Steam and Hydro, Kw.	Average Capacity Factor for 1933, Per Cent
Southern California Edison Co	2,760,500,000	949,940	33
Los Angeles Bur. of Power & Light	295,900,000*	110,605	31
Los Angeles Gas and Electric Co.	360,100,000	148,700	30
Southern Sierras Power Co.	245,400,000	67,732	41
Total	3,661,900,000	1,276,977	32 (aver.)

*Exclusive of energy purchased.

power generation begins, it becomes apparent that despite the early completion of the dam the date of first power delivery is still uncertain.

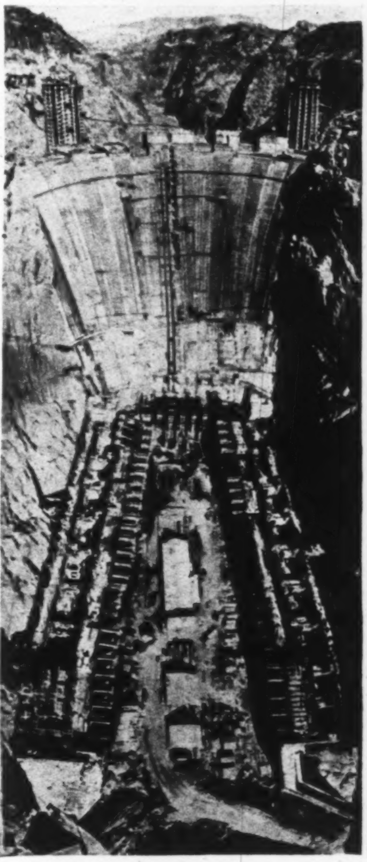
The Power Market

Bids for Boulder power were received on Oct. 1, 1929. Since then new factors have entered which materially change the power situation. Of first importance is the decline in power demand incidental to the years of depression. A decided flattening out of the load curve has appeared on the records of all the generating agencies. Both publicly and privately owned plants are operating under decreased load factors, with spare capacity on hand. The situation is in sharp contrast with the steadily increasing demand that was anticipated in 1929. Second comes the completion of Boulder Dam two years earlier than was provided for in the construction contract; this naturally suggests an earlier date at which power should be available and has introduced questions about *ad interim* power, the subject of recent negotiations. Third is the extremely low runoff from the Colorado Basin this year (only about 20 per cent of the average for the preceding 32 years). This low flow raises serious question about surplus water for power in a project so fully committed and bound by carefully drawn contracts to protect irrigation interests first and to generate no power at all until that can be done without interference with irrigation.

These factors all affect the present situation. The table on p. 690 gives the firm power allocations based on the assumption (used in the contracts) that the total firm horsepower available will be 4,420,000,000 kw.-hr. per year. If Arizona and Nevada are unable to make use of their share of this power, it is understood that the 18 per cent allotted to each of these states is to be divided equally between the city of Los Angeles and the Southern California Edison Co. until the states have need of it. It is to be noted that the allocation to the state of Nevada is more than 30 times the total amount generated in that state last year. New industries or other new markets for energy would be required to absorb any material part of the allocation. To the lesser degree but in like manner, as the tabulated figures show, Arizona apparently will not be able to use its allocation for some time.

If the source of power now generated in southern California were steam fuel exclusively, savings would result from switching to the Boulder supply. Such is not the case. Of the sources serving Los Angeles the installed capacity is about half hydro and half steam. In the first nine months of 1934, 71 per cent of the power used in Los Angeles was generated by hydro plants; in 1933 the percentage was 75.

Another point to be considered for future estimates is that the allotment to the Metropolitan Water District represents the total that ultimately will be required when the full 1,500 sec.-ft. is flowing in the aqueduct. Just what the rate of increase in power requirements on the aqueduct will be is not known at this writing. Figures for the initial and ultimate requirements for pumping are given on p. 688.



THE GREAT POWER HOUSES below Boulder Dam are here shown beginning to take form. Water entering the intake towers shown rising above the dam will pass through penstocks in tunnels in the canyon walls to the power houses, whose foundations are shown at the foot of the canyon walls in the foreground.

The foregoing indicates that present power requirements in southern California are being met by the installed capacity with an average load of about 30 per cent of the potential capacity of the installed generating equipment—not much over half the economic figure. In interpreting these figures allowance must be made for the fact that fluctuations of water yield limit the total available power quite irrespective of installed capacity.

On the second point—the earlier completion of the dam and the allocation of *ad interim* power—all three of the smaller cities, Pasadena, Glendale and Burbank, have petitioned for modification of their contracts. They ask for more time to develop load and for a lower rate during the load-developing period. Pasadena asks that the load-developing period (during which the original price of 1.63 mills for firm power is to be reduced to 0.5 mills per kw.-hr.) be extended to three years; Glendale asks for an extension to five years and Burbank for an extension to seven years.

Finally, in the matter of the river hydrology and the question as to when power can be generated at Boulder Dam, the argument has been advanced that the Colorado never has two successive years of extremely low runoff. On the other hand, the exact requirements of the Boulder Canyon Project Act in the operation of the reservoir become strikingly apparent when the necessity for storing 7,500,000 acre-ft. before any power is generated is considered in the light of this year's runoff. This year there was *no* surplus water; if the dam had been ready for storage this year, there would have been no progress toward the accumulation that must precede power generation.

This leaves in rather uncertain terms the question of when firm power can be delivered, and hence when financial returns will begin. More runoff and new industrial outlets for power are essential to carrying out the programmed power sale without interference with existing power services in southern California.

Meantime, the Boulder Canyon project as a whole is receiving high commendation for effective and speedy work and completion of the dam two years ahead of schedule. Delay in starting power development does not necessarily bear any serious significance; an engineer well versed in Colorado River hydrology recently said, "I think the opinion of all of us who have really thought about the matter is that there is more water available for irrigation than would be required to serve land really worth irrigation in U. S. territory, which could be reached either by gravity or a reasonable pumping lift."

Parker Dam Being Built for Metropolitan Water District

PARKER DAM is in nowise a part of the Boulder Canyon project, although it is being built simultaneously and by the Bureau of Reclamation. It is located about 150 miles below Boulder Dam and will form the pool from which water is to be pumped from the Colorado River into the aqueduct of the Metropolitan Water District of Southern California. The dam will raise the level of the river 85 ft., thus reducing the lift required for the aqueduct and at the same time providing head for a power plant in which water passing the dam may be used to generate power, part of which is to be used in the pumping plants.

The first of the five pumping stations along the aqueduct will be located on the west side of the river above the dam and will deliver water to the first tunnel of the aqueduct system on the hillside 290 ft. above the station.

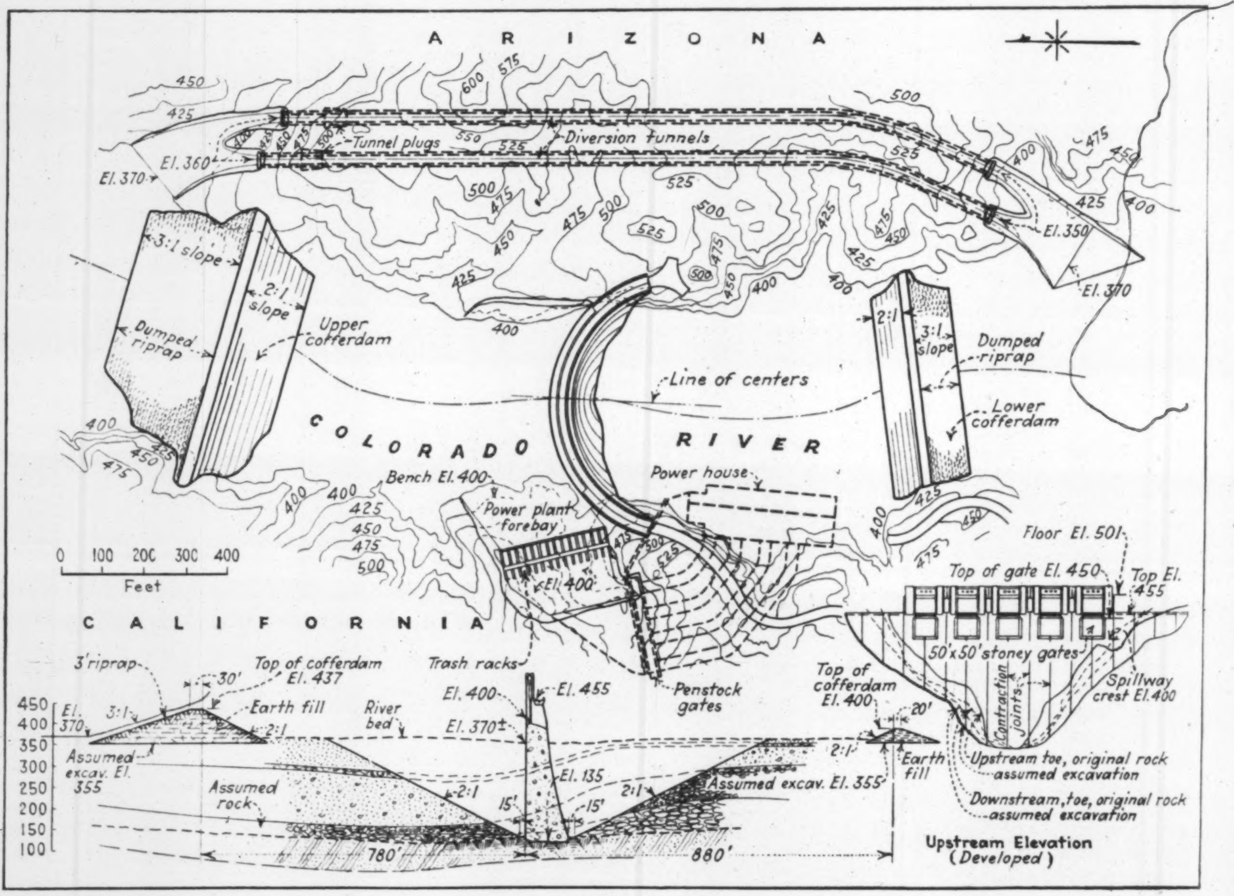
As previously noted, while Parker Dam is a part of the Colorado River Aqueduct system of the Metropolitan Water District and was to have been built and paid for by the district, it is now being built by the U. S. Bureau of Reclamation to avoid a controversy between the states of Arizona and California over the right of California to enter Arizona to build the dam (the dam being on the interstate border). Title to the dam is to remain with the federal government.

Distribution of power

Under the terms of the cooperative contract between the Bureau of Reclamation and the Metropolitan Water District, the government is to have the right to one-half the power privilege at Parker Dam for use in the irrigation and drainage of lands in Arizona within the Colorado River Indian reservation and the Parker-Gila irrigation project. The district is to have the right to one-half the power privilege for developing energy that would be used for pumping water into the Colorado River aqueduct. Preliminary plans call for a power plant at Parker Dam on the California side of the river, with an installed capacity of 80,000 kw. This is to be the total rated capacity in four units designed for operation under a head that will vary from 65 to 85 ft.

Parker Dam is to be a most unusual structure in that while it will raise the water surface only 85 ft. the main body of the dam will have a total height of 320 ft. from the bottom to the roadway on the crest. This is due to the depth of detritus overlying sound rock in the river gorge. The dam is to be of concrete-arch type, about 800 ft. long at the crest. Five spillway openings will be located in the center of the crest of the dam, each controlled by a 50x50-ft. stoney gate. On the right bank there will be a power house, four penstock tunnels, a penstock gate structure and a trashrack structure.

As at Boulder Dam, the river is to be diverted through tunnels, two 29-ft. horseshoe-shaped tunnels on the left bank being used; the site is to be unwatered behind earthfill cofferdams thrown across the river. A contract for the diversion tunnels, the cofferdams and the main dam totalling $4,240,000 was let in August of this year. It does not include the power house, penstock tunnels and forebay structures but does include the trashrack structure and part of the forebay excavation. The total cost is estimated at $13,000,000.

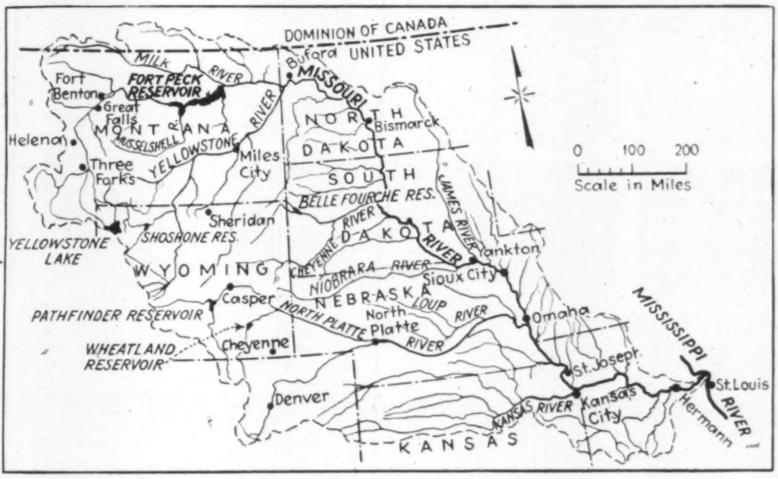

A R I Z O N A
C O L O R A D O
R I V E R
C A L I F O R N I A
Tunnel plugs
Diversion tunnels
El. 360±
El. 370
El. 350
El. 370
3:1 slope
2:1 slope
Dumped riprap
Upper cofferdam
Line of centers
2:1
3:1 slope
Dumped riprap
Lower cofferdam
Bench El. 400
Power plant forebay
El. 400
Power house
0 100 200 300 400
Feet
3' riprap
Top of cofferdam El. 437
30'
3:1
Earth fill
2:1
El. 370
Assumed excav. El. 355
Assumed rock
River bed
Trash racks
El. 400
El. 455
El. 370±
El. 135
15'
15'
2:1
2:1
Assumed excav. El. 355
Penstock gates
Top of cofferdam El. 400
20'
2:1
Earth fill
780'
880'
450
400
350
300
250
200
150
100
Floor El. 501
Top of gate El. 450
Top El. 455
50'x50' stoney gates
Contraction joints
Spillway crest El. 400
Upstream toe, original rock assumed excavation
Downstream, toe, original rock assumed excavation
Upstream Elevation (Developed)

PARKER DAM is unusual in that most of its 320-ft. height is to be below the present bottom of the river. A system of cofferdams similar to that at Boulder Dam is to be employed.

Fort Peck Dam—An $84,200,000 Aid to Navigation on the Missouri River

Development of the Missouri River for vessels of 9-ft. draft up to Sioux City, Iowa, to be advanced by construction of Fort Peck Reservoir—Some power to be generated—Flood benefits slight—Large amount of employment is created

THE GREAT RESERVOIR now under construction on the Missouri River at Fort Peck, 20 miles southeast of Glasgow, Mont., is primarily for navigation; power and irrigation are minor considerations, and even flood control is not an important factor because the reservoir is located in the semi-arid section of the river valley, far above the humid areas from which come most of the destructive floodwaters. Hence the essential justification for the present plan to spend about $84,200,000 in building the Fort Peck Dam is to be sought in navigation benefits.


DOMINION OF CANADA
UNITED STATES
Buford
MILK RIVER
Fort Benton
FORT PECK RESERVOIR
Great Falls
MONTANA
MUSSELSHELL R.
YELLOWSTONE RIVER
Helena
Three Forks
Miles City
MISSOURI
NORTH DAKOTA
Bismarck
SOUTH DAKOTA
BELLE FOURCHE RES.
CHEYENNE RIVER
JAMES RIVER
RIVER
Yankton
Sheridan
SHOSHONE RES.
YELLOWSTONE LAKE
WYOMING
NIOBRARA RIVER
Sioux City
NEBRASKA
LOUP RIVER
Casper
NORTH PLATTE RIVER
North Platte
PATHFINDER RESERVOIR
WHEATLAND RESERVOIR
Cheyenne
Omaha
MISSISSIPPI RIVER
St. Joseph
St. Louis
Denver
KANSAS RIVER
Kansas City
Hermann
KANSAS
0 100 200
Scale in Miles

FORT PECK RESERVOIR on the upper Missouri River in Montana has as its chief purpose the storage of floodflows to increase the low flow of the river in the interests of navigation from the mouth of the river up to Sioux City, Iowa, a distance of 768 miles.

Few of the larger projects that the government has undertaken as part of its public-works program were less well known than was the Fort Peck project when, about the end of October of last year, the Public Works Administration announced that it had allotted $25,000,000 for the construction of Fort Peck Dam on the Missouri River in Montana "to conserve water to assure an adequate flow for navigation in the Missouri River." Subsequent allotments have brought the total allotted to the project up to $50,000,000.

Lack of knowledge of the Fort Peck project was due to the fact that a Corps of Engineers report upon the development of the Missouri River for navigation, flood control, power and irrigation, which set forth the possibilities of a reservoir on the Missouri River near Fort Peck, had only recently been completed and had not been printed, nor had the whole project for coordinated development of the river contained therein been specifically considered by Congress. This report is one of the so-called "308 Reports" upon river development, authorized by Congress in 1927.

River characteristics

The Missouri River is formed by the junction of the Jefferson, Madison and Gallatin rivers at Three Forks in southwestern Montana, flows north and east through Montana, and then flows in a general southeasterly direction to a junction with the Mississippi River about 15 miles above St. Louis, a total distance of 2,470 miles. The drainage area is 529,000 square miles, and there is a total fall of 3,630 ft. From the headwaters to the vicinity of Great Falls, Mont., the river is gorgelike in character, and the surrounding country is mountainous. From Great Falls to Yankton, S. D., a distance of 1,370 miles, sloping arid lands and local "bad lands" are characteristics of the valley. From Yankton to the mouth of the river the valley is made up generally of rolling plains except where the river skirts the Ozark Plateau. Below Yankton both the bed and banks of the river are extremely unstable.

The average annual rainfall on the entire basin is 20 in., ranging from about 16 in. in the western part to 40 in. in the lower valley. The valley is classed as arid from Three Forks, Mont., to Niobrara, Neb., with a rainfall from 16 to 25 in. and is humid below Niobrara.

Floods of any considerable magnitude occur only in the lower valley. There are two normal high-water periods, a short one in April due to melting snow in the Great Plains area, and a longer and higher period between May 15 and July 15, which is a combination of melting snow from the headwaters and rain in the lower basin. The river has a maximum discharge at the mouth of 900,000 sec.-ft., a mean of 96,300 and a minimum of 12,500 sec.-ft.

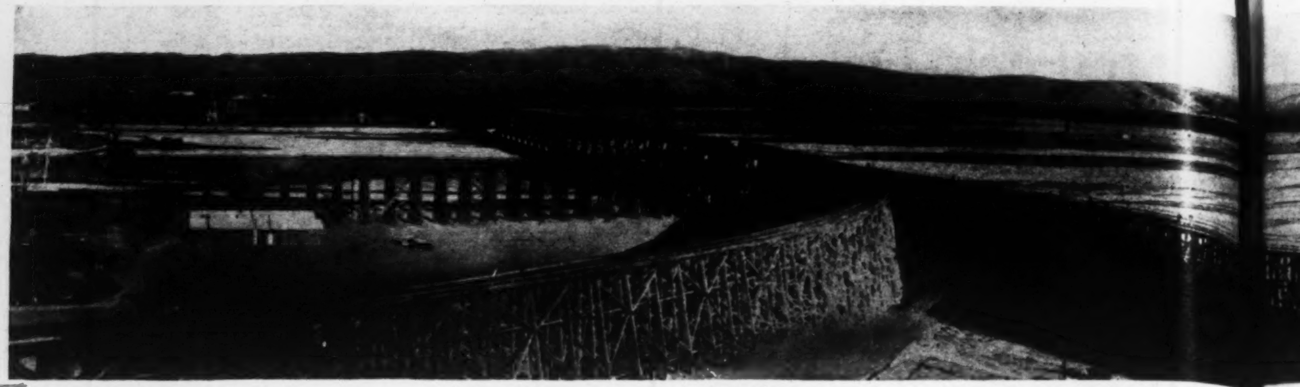
Navigation

FOR PURPOSES of navigation development, the army engineers have divided the Missouri River from its mouth up to the mouth of the Yellowstone River into three sections, as shown in the accompanying table.

Improvement of the river for navigation from its mouth up to Kansas City, a distance of 388 miles, has been under way since 1878. The present project for maintaining a channel depth sufficient for vessels of 6-ft. draft over a width of at least 200 ft., through the construction of permeable dikes and bank revetment and by snagging, is 97 per cent complete and had cost $65,000,000 up to the time the 308 Report was prepared. From Kansas City to Sioux City, Iowa, 380 miles, work on the 6-ft. channel is 15 per cent com-

TABLE I—PRESENT NAVIGATION DEVELOPMENT OF THE MISSOURI RIVER

Section	Present Objective	Estimated Traffic, Tons
River Mouth to Kansas City	6-ft. draft channel 200 ft. wide	3,729,437—6-ft. draft 5,389,975—9-ft. draft
Kansas City to Sioux City	6-ft. draft, no specified channel width	4,715,918—6-ft. draft
Sioux City to Yellowstone River	Snagging, no specified channel dimensions	8,216,269



LONG TRESTLES crossing the wide bottom lands along the river are the most conspicuous elements of Fort Peck Dam at the present time. These trestles are to be used this fall and through the winter

plete, and $11,000,000 has been spent upon it. Above Sioux City no attempt has been made to attain a specified depth. Snagging work and minor channel improvements have cost about $900,000. The controlling depth is about 30 in., and the present traffic is confined to ferries.

It is estimated that $61,000,000 will be required to complete the existing project below Sioux City. Congress has authorized the expenditure of $27,000,000 between Kansas City and Sioux City, and the PWA has allotted about $18,000,000 for expenditure between Sioux City and the mouth of the river, in addition to the money for Fort Peck Reservoir.

Conditions that control future navigation improvements

The army engineers, in preparing the 308 Report, extended their study of the navigation possibilities on the river beyond the projects already authorized by Congress, in order to determine what improvements can be made in the navigable channels by regulation of river flow. For this study the river was considered best suited to open-channel development as far up as Yankton, S. D., and to canalization above that point.

To secure a 6-ft. depth by flow regulation, a low flow of 20,000 sec.-ft. will be required at Yankton (80 miles above Sioux City) and at Kansas City, and 25,000 sec.-ft. at Hermann, Mo., 99 miles above the mouth.

Records prior to 1929 show that discharges of these magnitudes were obtained in the past during low-water periods except in a few instances where the flow was affected by ice conditions. However, in the three low-flow years, 1929, 1930 and 1931, discharges were below these figures for a considerable period. The army engineers, therefore, gave consideration to the construction of additional open-river work, to obtain the authorized channel dimensions with the present low flows, but no assurance could be found that it could be done. Hence they began a study of the possibilities of supplementing the flow by storage on the upper river.

From this study of storage of floodwaters it was found that a reservoir at Fort Peck of 6,400,000-acre-ft. capacity, estimated to cost $30,500,000, would assure a flow of 21,500 sec.-ft. at Yankton, and that a reservoir at Fort Peck of 17,000,000 acre-ft. capacity ($84,200,000) could be operated to maintain a minimum flow of 30,000 sec.-ft. at Yankton and 35,000 sec.-ft. at Kansas City. This flow is considered sufficient to maintain a channel for vessels of 8- to 9-ft. draft for 98 per cent of the navigation season.

The division engineer at St. Louis, in the 308 Report stated that he is of the opinion that the deficiencies of flow under the present 6-ft. draft project can be supplied by the construction of the smaller Fort Peck Reservoir, but that the work now contemplated under the present 6-ft. draft project would still have to be done at an estimated cost of $61,000,000. He did not believe that this expenditure is warranted because he was convinced that a width and depth sufficient for steamers drawing 7 ft. or more with downbound barge tows of at least 6,000-ton capacity would be necessary to attract long-haul barge traffic of bulk commodities. To secure such a channel—namely, a depth of 8 to 9 ft. from Yankton to the mouth of the river—would require construction of the larger Fort Peck Reservoir, estimated to cost $84,200,000. Further work required for the deeper channel includes completion of the stabilization work below St. Joseph, Mo. ($5,000,000), stabilization from St. Joseph to Sioux City ($56,000,000), and from Sioux City to Yankton, S. D. ($24,000,000), a total of $169,000,000. To this must be added the $65,000,000 already spent, making a total of $234,000,000.

The division engineer estimates that the annual maintenance charges on this channel will be $7,176,000.

Canalization of the river from Yankton up to the mouth of the Yellowstone River was estimated by the district engineer to require the construction of 23 locks and dams costing $248,000,000 and canalization from the mouth of the Yellowstone up to Fort Benton would require the construction of 19 dams at a cost of $155,000,000. However, no economic justification was found for this upper-river development.

Operation of the Fort Peck Reservoir for navigation would reduce deficiencies to flow in the Mississippi River at St. Louis where 77,000 sec.-ft. is required for satisfactory navigation. The deficiencies could be wholly made up by the larger Fort Peck Reservoir supplemented by the flow from a reservoir on the Kansas River near Topeka, one of several proposed on the lower tributaries of the Missouri for flood-control purposes.

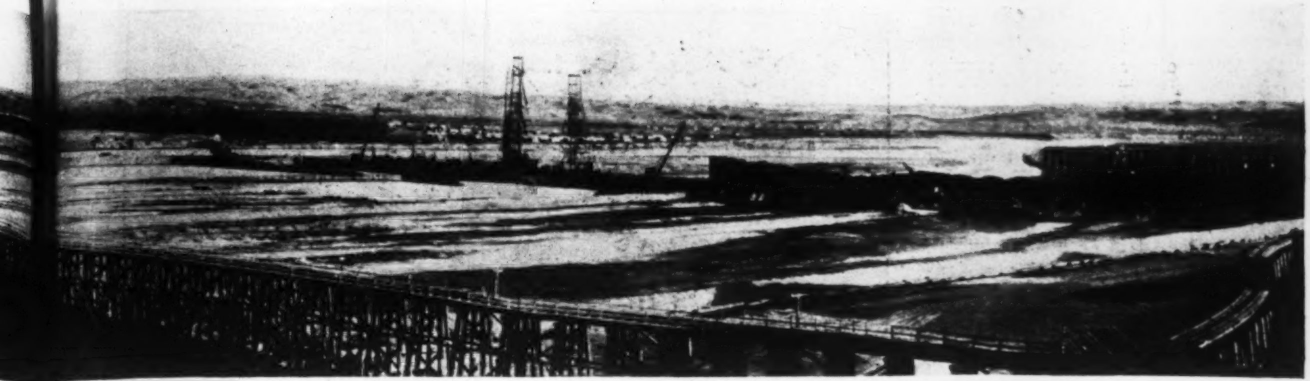
Flood Control

FLOOD CONTROL, irrigation and power development on the Missouri River system were considered by the army engineers in addition to navigation, in an effort to obtain an estimate of the cost and to determine the value of possible benefits.

Very destructive floods occurred in the years 1844, 1881, 1903, 1908 and 1915. In 1927 a flood of lesser magnitude occurred. About 2,121,800 acres of agricultural land are subject to overflow during destructive floods, with an

TABLE II—RESERVOIRS PROPOSED TO CONTROL MISSOURI RIVER FLOODS

Reservoir	Stream	Miles from Mouth	Gross Capacity, Acre-Ft.	Area Acres	Estimated Constr. Cost	Cost per Acre-Ft
Arlington	Gasconade	212	330,000	10,400	$3,930,000	$11.90
Chillicothe	Grand (Mo.)	300	2,400,000	107,000	31,730,000	13.02
Topeka	Kansas	471	4,200,000	104,000	61,008,000	14.50
Fort Peck	Missouri	1,878	5,700,000	108,000	28,507,000	5.00
Total			12,630,000	331,400	125,175,000	9.90



to build the rock and gravel fills for the upstream and downstream toes of the dam. In the spring, hydraulic dredges will begin pumping in the filling material that is to form the main body of the dam.

annual loss estimated at $4,500,000. Of this area, it is held that 760,000 acres can be protected by the construction of levees, river cutoffs and by storage of floodwaters in reservoirs. Further, it is estimated that 615,000 acres of agricultural land on the main stem of the Missouri are subject to overflow in a flood similar to that of 1903, and flood damage to these lands from 1903 to 1931 is estimated at $46,830,000. In the two Kansas Citys in this period the damage amounted to $31,050,000. Some of the areas now subject to overflow can be protected at a justifiable expense.

After a study of all available sites, the army engineers selected four sites as having the greatest possibility for Missouri River flood control. They are given in the accompanying table together with their capacity and estimated cost.

The capacity of 5,700,000 acre-ft. for the Fort Peck Reservoir given in Table II is a capacity based upon using the reservoir for flood control only, with no consideration given to navigation requirements.

The four reservoirs, incidentally, would have reduced the 1927 Mississippi River flood crest at Cairo by 11.8 in.

Reservoirs for power development in the mountainous region at the headwaters of the river, and reservoirs for the storage of irrigation waters in the arid region were considered, but it was found that neither would have any significant influence on flood conditions, chiefly due to the fact that they are in the arid region and supply little of the floodflow in the lower valley. Any reservoir above St. Joseph, Mo., can have little effect for this reason.

The district engineer states in his report that because the Fort Peck Reservoir lies about 1,500 miles from the lands below St. Joseph (lands that are to be protected from floodwaters) it is difficult to compute the flood benefit to be obtained from that reservoir. However, he estimates that by holding back a flow of 30,000 sec.-ft. it might be possible to reduce flood crests about 1 ft. This lowering would have affected a narrow strip along the edge of the valley, estimated at 81,700 acres in the flood of 1908, and at a less amount in the higher flood of 1903.

In the period 1903 to 1931 the possible reduction in damages is estimated at $4,344,000, and the range for major floods at $54,600 to $1,329,000, the latter in 1908, which was a 100-year flood in the upper basin where the Fort Peck Reservoir is located. This gives an average annual saving of $149,790. Capitalizing this at 5 per cent, it indicates a justifiable expenditure of $2,995,800, or about 11 per cent of the estimated cost ($28,500,000) of Fort Peck Reservoir for the smaller capacity of 5,700,000 acre-ft.

Effect of Fort Peck Reservoir on Mississippi River floods

The possible effect of storage reservoirs on the Missouri River and its principal tributaries upon floods in the Mississippi River was studied by the army engineers in the preparation of their report on the Missouri, especially as to the effect of the Fort Peck Reservoir. The critical period at Cairo on the Mississippi is from Feb. 15 to May 15. Allowing time for the travel of water from the upper Missouri, the period of flow that would contribute to the Mississippi in its critical period is Jan. 20 to April 19. Normally the flood period in the Missouri is May 16 to July 15. Consequently, if operated for the benefit of Missouri River flood control, the Fort Peck Reservoir would have little, if any, effect upon Mississippi floods. Occasionally the Missouri is a heavy contributor to late floods in the Mississippi, but this water comes from the lower section of the valley.

Irrigation

From Three Forks, Mont., to Buford, N. D., the Missouri basin is arid, with some dry farming to raise small grains. From Buford to Niobrara, Neb., the character of the valley changes from arid to humid (16 to 25 in. of rain), and there is extensive dry farming.

Existing irrigation projects in the upper Missouri River basin, totaling 131,200 acres, are all in Montana except 1,200 acres in North Dakota. All except the Fort Peck Indian irrigation project are outside the influence of the Fort Peck Reservoir and, consequently, the benefits to irrigation to be derived from the construction of the Fort Peck Reservoir are confined to that project.

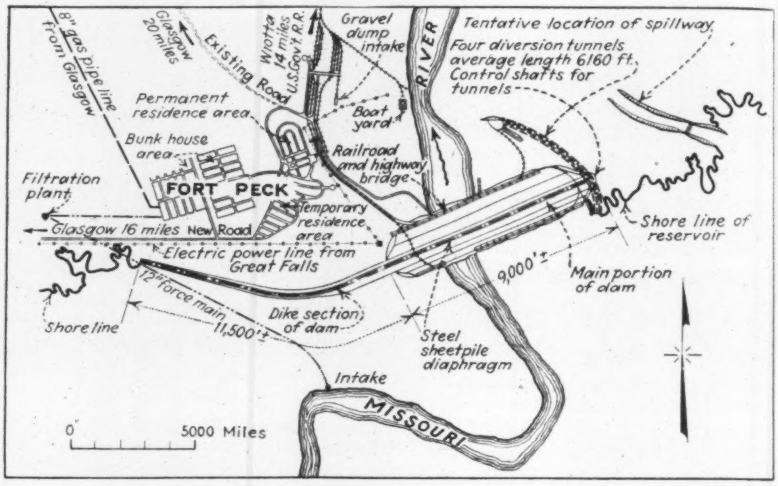
At the present time the Fort Peck Indian project has 17,400 acres under irrigation with water drawn from the Poplar and Little Porcupine rivers and from Big Muddy Creek. The project, however, can be expanded to include 113,000 acres of irrigable land, of which 83,600 acres would be supplied by water diverted from the Missouri River. Becaues of the power that will be made available by the construction of Fort Peck Dam, this water could be supplied cheaply by pumping with secondary power. To this extent construction of the reservoir can be considered as beneficial to irrigation.

Potential irrigation projects

Thirty-four potential irrigation projects on the main stem of the Missouri River were investigated, of which twelve, containing 131,450 acres, were considered of sufficient merit to warrant further study, to determine the cost of their development. This study demonstrated that none of them could be financed privately, and that nine of the twelve could not be developed under either private or federal financing. The remaining three, Silver, Galpin Bottom and Wood's Gulch (Scheme B), totaling 14,550 acres, were considered to be possible of development through the system of financing set up in the Reclamation Act. On the basis of repayment in 40 years, they would involve an annual payment of not greater than $4 per acre, the assumed maximum economic limit for the Missouri Valley.

The Silver and Wood's Gulch projects are above the Fort Peck Reservoir site and so unaffected by it. The third project, Galpin Bottom, would have its irrigable area reduced by 500 acres through the construction of the Fort Peck Reservoir and would require moving the pumping plant. No one of the potential irrigation projects below the Fort Peck Reservoir was considered to be economically feasible by the army engineers.

Consideration was given by the army engineers to the use of power developed incidental to or in combination with the storage of water for navigation for use in pumping water for irrigation projects, and it was found that with the large reservoir now contemplated some 180,000 acres of irrigable land would offer potentialities for development by the use of Fort Peck power for pumping.



THE MAIN DAM AT FORT PECK will have a crest length of 9,000 ft. A dike 11,000 ft. long brings the total length to 20,000 ft.

Power Development

OPPORTUNITIES for the development of hydro-electric power on the Missouri are confined to the section above the mouth of the Milk River, hence all except the plant at the Fort Peck Dam are above the sphere of influence of the Fort Peck Reservoir. In the upper part of the basin there are nine hydro-electric plants with a total installed capacity of 333,000 hp., but outside the mountainous region of the headwaters cheap fuel in easily accessible deposits has made steam the dominant source of power.

The 308 Report upon which the present Fort Peck development is based, proposed a reservoir of 17,000,000-acre-ft. gross capacity, to operate solely in the interest of providing adequate flows for navigation on the Missouri River below Yankton, S. D. Power development would be purely incidental to such operation, relying entirely upon the navigation releases during the navigation season and a minimum release of 1,000 sec.-ft. during the non-navigation season. The maximum gross power head would be 200 ft. An initial plant capacity of 50,000 kw., to be installed under a normal head of 150 ft., was proposed. With the 1,000-sec.-ft. minimum release under the varying head conditions due to reservoir drawdown for navigation, a potential 12,000-kw. rate of output was considered to have primary value. Potential average annual power output was estimated to be 99,110,000 kw.-hr. of primary and 220,210,000 kw.-hr. of secondary. Capital cost of the power features only was estimated at $1,970,700, or roughly $40 per installed kilowatt. Estimating fixed charges at 10 per cent of the capital cost and operating charges at $1.60 per installed kilowatt, the annual charges would be $277,070. Assuming that all secondary output could be sold at 1 mill per kw.-hr. and credited to the development, the cost of primary production would be 0.57 mill per kw-hr. On the basis that primary power is worth 6 mills at the Fort Peck low-tension switchboard, it should be possible to show a profit of 5.43 mills. The capitalized value of the power privilege, therefore, was set at $5,400,000.

These figures are tentative. Studies now are in progress to revise them on the basis of an increase in reservoir capacity from 17,000,000 to 18,080,000 per cubic foot.

Incorporation of the Fort Peck Reservoir in a fourteen-plant power and navigation development of the Missouri River above the mouth of the Milk River, with the power installation at Fort Peck increased to 400,000 kw., was considered in the 308 Report, as was a fifteen-plant straight power system that would utilize a lower dam at Fort Peck. As this study showed that the power output of the combined power and navigation system would be greater than the output of the straight power system, it follows that the inclusion of the navigation features involves a power privilege of measurable value. Based upon the assumption that navigation and power interests should share equally in the benefits resulting from the combination, the ultimate power privilege is estimated in the 308 Report to be approximately $35,000,000.

Present Undertaking

ALTHOUGH the study summarized in the foregoing was completed in 1932, certain elements of it were continued by the engineers of the Kansas City District and the Missouri River Division, and as a result some minor modification of the plans therein laid down have been made. This is especially true of the river-flow studies that have resulted in an increase in the capacity of the Fort Peck Reservoir.

Included in the work now under way at Fort Peck are the following projects: formation of a reservoir with a capacity of 19,412,000 acre-ft. through the construction of an earthfill dam across the Missouri River; construction of four 26-ft. tunnels for the diversion of the river during construction of the dam and, subsequently, for river control and power development; building of a power plant, and the installation of 50,000 kw. of generating equipment; excavation of a spillway channel and construction of a spillway weir to regulate the discharge of floodwaters to the river about 1 mile below the dam. Construction of 12 miles of railway and 16 miles of highway to give access to the dam, and the construction of a 288-mile transmission line to bring power from Great Falls, Mont., as well as the construction of camps for housing about 7,000 men also are included.

The dam is to be an earthfill made of sedimentary and alluvial valley material placed hydraulically. It will have a maximum height of 242 ft., a crest width of 100 ft., a crest length of 9,000 ft. over the main portion and 11,000 ft. over the dike portion. The maximum width at the base will be 2,875 ft. Side slopes are to be 1 on 4 upstream and 1 on 8½ downstream, an unusually flat slope being adopted as a safety measure in view of the conditions to be met.

Beneath the dam there is to be a steel sheetpile cutoff, 9,250 ft. long across the valley, driven down into firm shale.

The total quantities involved are 100,000,000 cu.yd. of earth, 1,600,000 cu.yd. of rock on the upstream slope, 4,000,000 cu.yd. of gravel in the toes, and 37,000,000 lb. of steel sheetpiling.

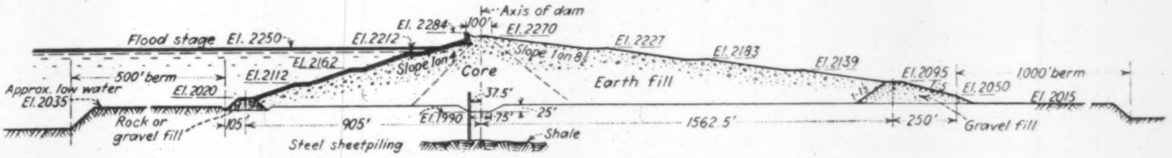
The four diversion tunnels will have a finished interior diameter of 26 ft., an average length of 6,160 ft. and a capacity of 84,000 sec.-ft., with the reservoir surface at El. 2,250, the maximum elevation. After construction of the dam the tunnels will serve as outlets for flow-regulation purposes, and as penstocks for the hydraulic-power development.

The spillway channel will require the excavation of 8,000,000 cu.yd. of earth and the installation of 400,000 cu.yd. of concrete.

Four 28-in. electric dredges to be used in placing the hydraulic fill have been built at the site. Each is equipped with two 2,500-hp. electric motors on the two pumps and one 750-hp. motor on the cutter head. A complete dredging unit will consist of one dredge, one booster barge and one land booster, the total power capacity of each unit being 13,250 hp. Power is to be brought in from Great Falls over a 154,000-volt transmission line.

Reservoir capacity

The reservoir formed by the dam will have a maximum gross capacity of 19,412,000 acre-ft. at El. 2,250, will have an area of 245,000 acres, a length of 140 miles, a maximum width of 16 miles, and a shoreline of about 1,600 miles. The reservoir area has been homesteaded and improved only in a small degree and is generally devoid of timber, except along the stream and in the river bottom. Relocation of highways and utilities will be negligible, and the value of land to be flooded is rather low.



THE FORT PECK DAM is to be of hydraulic fill with toes of rock and gravel. The base has been made unusually broad to give the dam great stability.

The normal operating capacity of the reservoir (spillway level, El. 2,246) is placed at 18,080,000 acre-ft., and the dead storage will amount to only 366,900 acre-ft., which is at El. 2,085. Of this dead storage it is estimated that 225,000 acre-ft. will absorb all the silt that will come into the reservoir in a period of 100 years.

The reservoir is to be operated so as to maintain a minimum flow of 30,000 sec.-ft. at Yankton, S. D., from March 16 to Nov. 15, and a drawdown of at least 3,350,000 acre-ft. or more, dependent on navigation requirements, to a maximum capacity of 14,730,000 acre-ft. by Nov. 16 (Yankton date) each year.

The 3,350,000-acre-ft. drawdown will provide for the storage of normal floodflows. In the spring, floodwaters are to be accumulated until storage reaches 18,080,000 acre-ft. (El. 2,246), when a constant pool level is to be maintained by passing surplus flows up to 50,000 sec.-ft. through the tunnel outlets. Floodflows in excess of 50,000 sec.-ft. are to be accumulated in the reservoir until the maximum effective capacity (19,044,000 acre-ft.) is attained, when the spillway will go into action.

From a record of the flow of the Missouri River at Fort Peck dating back to 1890, the engineers in the district office at Kansas City have constructed a storage graph for the reservoir as proposed to be built. This shows that the reservoir, if built in 1890, would have been filled to normal pool height by 1893 and would have spilled every year from 1893 to 1900, would have been drawn down to a capacity of 9,500,000 acre-ft. in 1902, would have filled to normal pool height again in 1904 and again from 1907 to 1918, except for one year. It would have been down to 9,600,000 in 1919 and would have filled again in each year from 1924 to 1929. No water in excess of that required for navigation would have been released since 1929, and by July, 1934, the capacity of the reservoir would have been down to 3,700,000 acre-ft. In this period of 40 years the spillway would have been in use only one year, 1917, and the spill for that year would have been 33,000 acre-ft.

The design of the spillway is based on the occurrence of a probable maximum flood producing an inflow into the reservoir of 380,000 sec.-ft., about 2½ times the maximum flood of record. The spillway itself will have a discharge capacity, with a large factor of safety, of 255,000 sec.-ft. at the pool elevation of 2253.5 ft., which will safely pass the maximum flood independently of the tunnels.

Construction of the dam has been under way since Oct. 24, 1933. An account of the construction operations is to be published in the near future.

Costs and Savings

THE MAJOR FACTORS that have to be considered in reaching a decision as to whether or not construction of the Fort Peck Reservoir is justified on purely economic grounds have been outlined in the foregoing. They show clearly that the chief purpose of the reservoir is to improve the navigability of the lower river, and that possible power and flood-control benefits are purely incidental to the main purpose of the reservoir.

Excluding from consideration the $65,000,000 already spent in improving the navigability of the river below Yankton, S. D., the expenditures yet to be made to provide a channel of 9-ft. depth are estimated by the army engineers to total $145,000,000, made up as shown in the following figures:

Stabilization below St. Joseph, Mo. . .	$5,000,000
Stabilization St. Joseph to Sioux City	56,000,000
Construction of Fort Peck Reservoir.	84,200,000
	$145,200,000

Deducting from this the capitalized value of the flood benefits of the reservoir, estimated by the district engineer to be $5,000,000 for the larger reservoir; and the $5,400,000 that he estimates as the value of the power privilege with the initial installation, leaves $134,800,000 chargeable to navigation.

In 1932, in presenting his original report the district engineer stated that commercial interests estimated the commerce that would move over the waterway between Yankton and the mouth at 10,252,000 tons annually, at a saving in freight charges of $14,600,000.

On the basis of these figures the division engineer stated that he was unable to convince himself that the undertaking was sound. Subsequently, however, the district engineer, on the basis of a deeper waterway which he favored, estimated the tonnage from Sioux City to the mouth at 11,800,000 and the annual saving at $11,760,000, or $1 for every ton moved. As the estimated annual cost of maintaining and operating the waterway is placed at $7,176,000, the annual saving, based on this estimate of traffic, is $4,584,000 for an expenditure of $134,800,000.

Reviewing the district and division engineers' reports, the board of engineers for rivers and harbors stated that it had doubts as to whether a dependable 9-ft. channel could be obtained with the projected discharge for the Fort Peck Reservoir, and that it was not convinced that the anticipated commerce will develop or that the estimated savings in freight will be realized. It stated further that the incidental benefits to irrigation, to power and to lands subject to overflow were so intangible as to be unpredictable of evaluation.

A make-work project

From the foregoing it is apparent that the Fort Peck Reservoir would not have been built under normal circumstances. The only reason that it is now being built is because it was an undertaking that held out a prospect of creating a large amount of employment over a period of several years in a section of the country where it was difficult to find such jobs to be financed by the Public Works Administration.

That it was the exigencies of finding

projects in the upper Missouri valley rather than economic considerations that brought about approval of the project is evident from a review of the circumstances surrounding its adoption.

Construction of the Fort Peck Reservoir was not included in the first list of projects for PWA financing. The Recovery Act had not been passed when the district engineer submitted his report, hence he made no recommendation as to considering any of the work for PWA financing. The division engineer did not think the project economically sound, as previously noted. By the time the board of engineers for rivers and harbors came to pass on the district engineer's report, the Recovery Act had been passed and the board was asked to consider recommending some of the work outlined in the report to the PWA for financing. That board, however, declined to make such a recommendation, and stated that it found no economic justification for the work; hence any decision as to recommending the work for PWA financing should be made by higher authority.

By that time, apparently, pressure on the War Department for PWA projects must have been increasing, for the then Chief of Engineers, in transmitting the report to the Secretary of War, took an entirely opposite view, recommending that the navigation project for a channel from 8 to 9 ft. deep between Sioux City and the mouth of the Missouri (768 miles) be vigorously pressed to completion, that the Fort Peck Reservoir be built to the maximum capacity, and that an expenditure of $145,000,000 be authorized by Congress as part of the regular river and harbor work.

That was on Sept. 30, 1933. On Oct. 10 the War Department recommended to the PWA that construction of Fort Peck Reservoir be included in its federal program. The department, in its letter to the PWA, stated that "The navigation benefits that would result from the provision of the 8-9-ft. channel in the Missouri River were estimated at $11,000,000 annually; that the present channel maintenance charges would be reduced by approximately $500,000 annually; that the flood control afforded by the dam would eliminate property losses averaging annually $2,000,000; that an adequate supply of healthful domestic water for an urban population of 2,000,000 would be insured; that land erosion aggregating $2,000,000 annually would be eliminated and that the initial power installation as a unit plant had a value of approximately $5,000,000, with an ultimate value of $35,000,000 if connected in the future with a complete power system. In addition, the construction of the dam makes economical irrigation feasible for approximately 80,000 acres of land."

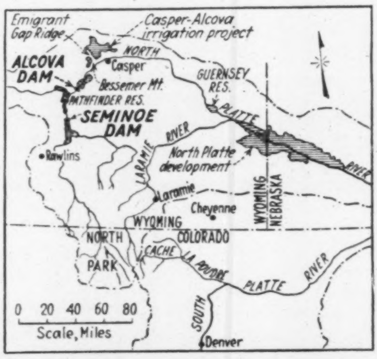
In comparing these predictions of benefits with the foregoing summary of the findings of the 308 Report, it should be noted that the estimated annual savings to transportation were seriously questioned by the board of engineers for rivers and harbors, that the district enginer found no such high annual reduction in flood losses, and that he included no figure for possible savings due to reduction of soil erosion. Further, a figure of $35,000,000 as the ultimate value of the Fort Peck power privilege has no place in computation of benefits to be obtained from the present expenditure because it can be obtained only by the much larger expenditure involved in increasing the installed capacity from 50,000 to 400,000 kw. and in building the remainder of a fourteen-plant power and navigation system of which it must be made a part to obtain this higher value.

Though so definitely weak in economic respects, the Fort Peck project has been a real work-producing undertaking. In this respect it stands out among the large projects financed by the PWA. The first allotment was made on Oct. 24, and by December more than 700 men were on the job, and by January the total had reached 1,000. Over 4,000 were at work by May, and by July 15 the 7,000 mark had been passed. This number of men will be employed up until the middle of December, when weather conditions will require the curtailment of some operations, bringing the active employment down to about 4,000. By March all operations can be resumed and the dredging work will be begun. From then on through the summer the average employment is expected to be around 6,000. Five years will be required to complete the project.

Irrigation and Power on the North Platte River

Casper-Alcova irrigation project and the Seminoe Dam for the storage of irrigation water and for power were financed under conditions that did not permit early start of work—Irrigation costs abnormally high—Involved water-rights question now delaying work

TWO MAJOR ELEMENTS of the combined power and irrigation project on the North Platte River in Wyoming have had $22,700,000 earmarked for their early construction. They are the Casper-Alcova irrigation diversion dam and 106-mile canal and the Seminoe storage and power dam. The former, the irrigation unit, calls for the construction of a dam across the river near Alcova about 10 miles below the Pathfinder Reservoir and the building of a canal system to supply water to 66,000 acres of irrigable land lying to the north, west and southwest of Casper; the latter (the storage and power unit) calls for the construction of a dam across the river in the heart of the Seminoe Mountains, a few miles above the upper end of the Pathfinder Reservoir, to store 1,000,000 acre-ft. of water for power and irrigation of the Casper-Alcova lands, together with a power house below the dam to develop 38,400 kw. of power from water as it is discharged from the Seminoe Reservoir into the Pathfinder Reservoir.



NORTH PLATTE River Valley, showing the location of Alcova and Seminoe dams and the Casper-Alcova irrigation project.

In this remarkable combination project the economic and public-benefit questions are highly complex and difficult to evaluate. On the one hand, the irrigation works will cost far more than can be repaid by the land to be irrigated. On the other hand, the argument is very strongly made that there is urgent need for an agricultural development in the area around Casper. These opposing facts raise the question of how far the federal government is justified in furnishing money for a regional development that can return only a small part of its cost and that must be supported by the revenues of a power plant not needed for irrigation service.

According to common reports, the truth is that the project was not selected

ALCOVA CANYON in which it is proposed to build the diversion dam for the Casper-Alcova irrigation project. The dam, an earth and rockfill structure, is to be located at the near end of the canyon.

or adopted for its economic soundness, but was placed on the list of federal public works for allocation from the PWA emergency fund at the instance of a senator representing the state. It is generally conceded that the money was allotted on a geographical basis rather than because it would be a profitable business undertaking.

Thus it is to be judged primarily as an employment-producing project. On this score the sad fact is that in the sixteen months since the money was allotted to the project only a small amount of employment has been created (700 men at the maximum), chiefly because unusual geologic conditions at the Alcova Dam slowed up the design of the principal structures and because the inaccessibility of the Seminoe site and the lack of complete exploration of the area made it impossible to start construction there. In October of last year the PWA, recognizing that the project could not get under way quickly, cut the allotment to $12,000,000.

Now, after about $900,000 worth of contracts have been let, any new work is practically at a standstill due to a controversy over water rights. In addition, a sensational question of soil chemistry and possible plant poisoning has arisen, and the necessity of obtaining a conclusive answer of favorable character before more money is invested in building the irrigation system is likely to cause further delay.

More farms needed

The Casper-Alcova project is located in central Wyoming in the vicinity of Casper, a city of 16,600 population and the site of three large oil refineries. The area is in the center of an extensive range country, and the present irrigation development is too limited to supply stock men with winter feed and to furnish Casper and the near-by oil fields (chief among them the Salt Creek field, adjoining the famous Teapot Dome to the north) with required foodstuffs. Construction of the proposed irrigation project, therefore, is expected to fill a great community need and to be of particular benefit to the city of Casper and the local range and livestock interests, the more so as the oil business has declined sharply.

Climate and soil

Elevations are somewhat in excess of 5,000 ft.; the climate is semi-arid, with relatively cold, though open, winters and moderately cool summers. The yearly precipitation is 14.66 in., with the highest fall in April and May. The growing season is long enough for sugar beets, alfalfa, and ordinary field crops, but the lack of long periods of warm growing weather is expected to limit yields and delay maturity when compared with regions of lower altitude.

The soils are mainly alluvial and are derived from shales and sandstones. Outside of, but adjacent to the lands considered irrigable, there is some white alkali in the depressed areas and in the flatter heavy-textured valleys. Some indications of black alkali (sodium carbonate) are found in more restricted areas, particularly in the subsoil. The most extensive areas of good irrigable land occur on old river terraces, now existing as mesas, along the 33-Mile Trail and the Salt Creek Highway, northwest and north of Casper. The principal bodies of non-irrigable land are heavy alkaline flats, raw residual-shale soils, and rough wind-blown sand areas.

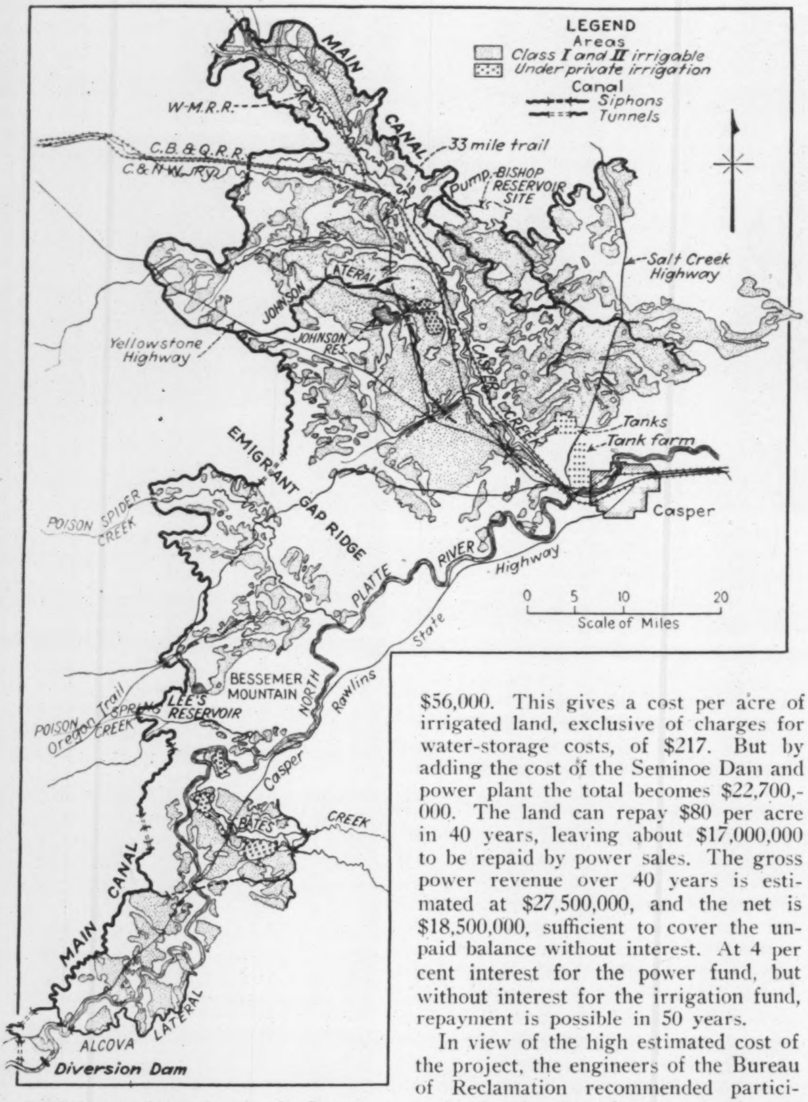
The irrigable land, which after thorough soil examinations has been carefully selected from a tract of 221,000 acres, totals 66,000 acres. Greasewood lands, rough areas and shallow soils were excluded. The selected area extends northeast from Alcova Gap in a comparatively narrow strip, interrupted by several ridges, 20 miles along the North Platte River, then widens out north of Emigrant Gap Ridge and reaches a maximum east-west width of 23 miles at a point 16 miles north of Emigrant Gap Ridge and 6 miles north of Casper. The project has a maximum length, north and south, of 37 miles. The area north of Emigrant Gap Ridge is fairly continuous topographically, but is badly cut up by bodies of non-agricultural land.

Practically all the irrigable lands are in private ownership and, except for a few hundred acres, are in the raw stage and used for grazing. Such lands have sold at $500 to $1,000 per section (640 acres). A class I irrigated farm on Bates Creek is held for $80 per acre.

Character of farm units

The U. S. Bureau of Reclamation, in its report on the project, stated that farm units should vary from 40 to 160 acres of irrigable land, depending on location and type of farming, that sugar beet farms will generally need to have 100 acres, and dairy farmers a smaller area. Two main types of farming will develop: one with sugar beets as the main crop, supplemented by alfalfa, peas, barley and oats; the other will have dairying as the main business, growing forage and feeding it to cattle and hogs. Winter feeding of range stock with alfalfa, beet tops and pulp from the sugar factories should become a major industry. Farmers with practically all their acreage in production might expect a crop return of $31 per acre, but the low returns of unsuccessful farmers and idle irrigable lands that must be expected would lower the project average to about that of the Shoshone project, which (at 1928 prices) was a little in excess of $22 per acre.

The engineers of the Bureau of Reclamation state that unless there is a marked improvement in agricultural conditions the maximum assessment for ir-



LANDS to be irrigated under the Casper-Alcova project lie mostly to the northwest of Casper, with smaller isolated areas beyond Emigrant Gap Ridge to the southwest.

rigation water that these lands will stand will be $4 per acre of first-class land and $3.25 per acre of second-class land, with a project average of $3.50 per irrigable acre. Deducting $1.50 for cost of operation and maintenance leaves $2 per acre to be applied on the annual construction payment. In 40-year repayment under the 1925 Adjustment Act amendment to the Reclamation Law, this means that the total farm repayment cannot be expected to average more than $80 per acre.

Construction costs

The total cost of the irrigation works (dam, canal and distribution system) is placed at $14,305,000, divided as follows: Alcova Dam, $3,339,000; main canal, $6,853,000; laterals, $2,077,000; drains: $1,980,000; telephone system, $56,000. This gives a cost per acre of irrigated land, exclusive of charges for water-storage costs, of $217. But by adding the cost of the Seminoe Dam and power plant the total becomes $22,700,000. The land can repay $80 per acre in 40 years, leaving about $17,000,000 to be repaid by power sales. The gross power revenue over 40 years is estimated at $27,500,000, and the net is $18,500,000, sufficient to cover the unpaid balance without interest. At 4 per cent interest for the power fund, but without interest for the irrigation fund, repayment is possible in 50 years.

In view of the high estimated cost of the project, the engineers of the Bureau of Reclamation recommended participation by the city of Casper to the extent of paying at least one-fourth of the total construction cost. The benefit to the city of Casper would be greater than is generally the case of communities located in irrigated areas because of the fact that that city is now dependent on outside sources of supply for most of its foodstuffs and because of the uncertainty of the life of the local oil fields, the principal support of the community. However, no city participation was stipulated or arranged.

Water supply

The Casper-Alcova project contemplates no draft from the Pathfinder Reservoir. However, the whole system of reservoirs (Seminoe, Pathfinder, Alcova and Guernsey) would necessarily be operated each to the increasing advantage of the lower lands. The net increase in draft on the North Platte River occasioned by the Casper-Alcova project (at a water duty, net, of 2.10 acre-ft. per acre average, with range from 1.95 to 2.5 acre-ft.), according to the engineers of the Bureau of Reclamation, would not be heavy, since return flow from the project would be usable by other areas now developed. The amount of water taken by the project and not returned to the river is estimated at 106,000 acre-ft. annually.

Runoff data for the North Platte River extending back to 1895 were reviewed by the engineers of the Bureau of Reclamation in their 1930 report on the Casper-Alcova project. This study indicated that with both the Casper-Alcova and the North Platte projects fully developed there would have been four years of minor shortages, five of moderate shortages and two years of destructive shortages. This year, without any draft for the Casper project, there have been shortages on the North Platte Irrigation project as now developed.

Water-right controversies

Thus it appears that the waters of the North Platte River are already wholly appropriated and utilized, save for the possibilities of carry-over storage covering periods of years. Because the drafts on the river for irrigation are thus heavy, the people who depend on the river for water have for years sought to obtain an agreement between the states of Colorado, Wyoming and Nebraska which would allocate the water among the three states through which the river flows. In particular, Colorado wanted to take more water from the river. Both Colorado and present downstream users objected to any new diversions of water from the river until such a compact could be signed. However, to date it has not been found possible to reach an agreement on account of the wide divergence between the claims of the three states as to the amount of water to be allocated to each. These circumstances make Seminoe Reservoir clearly essential to the security of the new irrigation area.

In view of the failure to reach an agreement it was to be expected that, when in August of last year the Public Works Administration announced that it had allocated money for the construction of the Casper-Alcova project, strong objections would come from the state of Colorado. Even the inclusion of the Seminoe Reservoir to increase the available storage did not check the protests that were made to the President because that reservoir, being downstream of the Colorado line, could not be used to serve Colorado.

The North Platte River rises in the North Park section of Colorado, and it is estimated that in the long-time average Colorado contributes about 654,000 acre-ft. of water per year, Wyoming 1,977,000 acre-ft., and Nebraska 657,000 acre-ft., as shown in the accompanying table. Colorado now consumes an average of 127,000 acre-ft. for irrigation in

PROPORTION OF TOTAL FLOW OF THE PLATTE RIVER ORIGINATING IN COLORADO, WYOMING AND NEBRASKA

State	In Units of 1,000 Acre-Ft. North Platte River	South Platte River	Total
Colorado	(1) 654	(3) 2,090	2,744
Wyoming	(2) 1,977	(4) 52	2,029
Nebraska	657	0	657
	3,288	2,142	5,430

(1) Sum of average flow Laramie River at Jelm, Wyo. (114,000 acre-ft.), North Platte River at Northgate, Colo. (370,000 acre-ft.), mean consumptive use in Colorado, 1922–1934 (127,000 acre-ft.) and transmountain diversions to South Platte (43,000 acre-ft.).

(2) Difference between estimated undepleted flow at Wyoming-Nebraska state line and water originating in Colorado. Undepleted flow at Wyoming-Nebraska state line, estimated as sum of North Platte at Bridgeport, Neb., 1922–1934 (1,511,000 acre-ft.), estimated irrigation depletion in Nebraska for area above Bridgeport, 1922–1934 (302,000 acres @ 1.5 acre-ft. per acre), estimated irrigation depletion in Wyoming and Colorado, 1922–1934 (724,000 acre-ft.), and transmountain diversions to South Platte (43,000 acre-ft.) reduced by 100,000 acre-ft. to allow for tributary inflow between the state line and Bridgeport.

(3) Estimated as average flow South Platte River at Julesburg, Colo., 1922–1934 (321,000 acre-ft.), plus irrigation depletion in Colorado (1,829,000 acre-ft.), less transmountain diversions to South Platte drainage area (60,000 acre-ft.).

(4) Estimated from fragmentary records on Lodgepole Creek at Bushnell, Neb., and past irrigation depletions in Wyoming.

IRRIGATION USE OF THE WATERS OF THE NORTH AND SOUTH PLATTE RIVERS

	In Units of 1,000 Acre-Ft. North Platte River	South Platte River	Total
Average past flow at North Platte, Nebraska(1)	1,967	310	2,277
Past upstream irrigation depletion			
Colorado	127	1,829	1,956
Wyoming	597	21	618
Nebraska	554	42	596
Transmountain diversions (in Colo.)			
North Platte Basin to South Platte	43	—43	0
Colorado River to South Platte	....	—17	—17
Total undepleted flow	3,288	2,142	5,430

(1) Average for years 1922 to 1934, incl.

the North Platte Valley and diverts 43,000 acre-ft. into the Cache la Poudre, a tributary of the South Platte for irrigation in that basin. Colorado is anxious to increase this diversion to make up present deficiencies in the irrigation waters. Wyoming uses an average of 597,000 acre-ft. and seeks more water for the Casper-Alcova and Saratoga projects. Nebraska uses an average of 554,000 acre-ft. and requires more for complete development of the North Platte and other irrigation projects.

Water for Casper-Alcova

Back in 1904 when development of reclamation projects along the North Platte River, including the Casper-Alcova project, was first considered by the Bureau of Reclamation, the bureau filed an application for a permit to divert water to irrigate 22,000 acres in the Casper-Alcova project, but the application was not acted upon. It had been held as an application, without issuance of a permit, for 30 years when, early in 1934, the bureau requested the state engineer of Wyoming to issue a permit on the application. In September the state engineer granted the permit, limiting the diversion to the 66,000 acres, *but with the stipulation that the permit should not affect rights of water-users above, even though appropriated after 1904.* This unprecedented permit, which represents in effect a 1934 priority instead of a 1904 priority, is now the subject of active legal discussion. Pending settlement of the permit question, the Bureau of Reclamation has declined to let any further contracts for the project. It may be said that the legal advisers of the bureau believe that the state engineer has no power to attach conditions. The law states that he may (1) return, (2) approve or (3) reject the application.

Senator Kindrick, in presenting the Casper-Alcova case to PWA, stated that Wyoming's contribution to the Reclamation fund, up to the end of 1931, was $38,660,000, and that the state had received but $18,880,000 for projects in Wyoming, that Colorado contributed $10,510,000 and received $13,280,000, and that Nebraska contributed but $2,090,000 and received $15,200,000. This statement looks back to the provision of the 1902 Reclamation Act, which directed that if possible the Reclamation Fund be allocated in proportion to the contributions made to the fund by the several states. The provision has long since been repealed. The Casper-Alcova money, of course, comes from the $3,300,000,000 public-works fund set up under the Recovery Act.

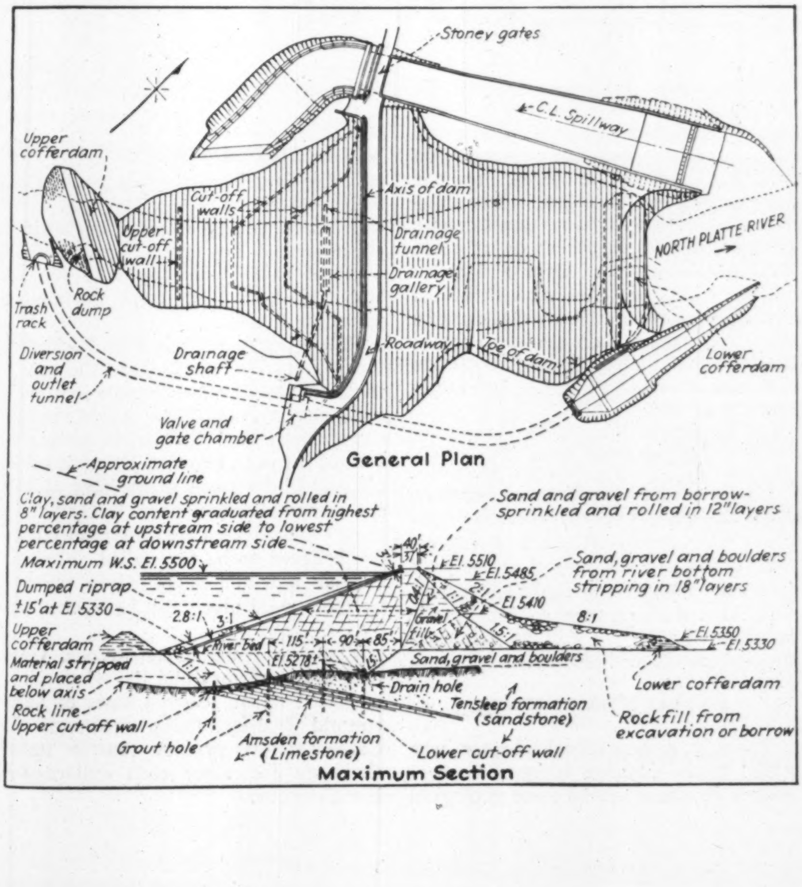
Alcova Dam

The Alcova Dam is to be built at the lower end of Alcova Canyon, about 32 miles up the river from Casper. It is to be an earth and rockfill structure, 232 ft. high and about 1,000 ft. long at the crest.

An outlet tunnel, 20 ft. in internal diameter, has been completed through the south wall of the canyon to serve as a diversion tunnel during construction of the dam and as an outlet tunnel after the dam is in service. A spillway is to be cut through the ridge to the north of the dam, with a paved spillway channel discharging into the river below the toe of the dam.

The principal details of the structure are given in an accompanying drawing. Its character and location were determined chiefly by the fact that the rock forming the upper part of the canyon is a porous limestone through which

ALCOVA DAM is to be an earth and rockfill structure of unusual character due to the rock formation in the Alcova Canyon. Springs of hot water rise into the river along a fault zone about on a line with the upstream toe of the dam.


Stoney gates
C.L. Spillway
Upper cofferdam
Cut-off walls
Axis of dam
Upper cut-off wall
Drainage tunnel
Drainage gallery
NORTH PLATTE RIVER
Rock dump
Trash rack
Roadway
Toe of dam
Diversion and outlet tunnel
Drainage shaft
Lower cofferdam
Valve and gate chamber
General Plan
Approximate ground line
Clay, sand and gravel sprinkled and rolled in 8" layers. Clay content graduated from highest percentage at upstream side to lowest percentage at downstream side
Sand and gravel from borrow-sprinkled and rolled in 12" layers
40'
37'
Maximum W.S. El. 5500
El. 5510
El. 5485
Sand, gravel and boulders from river bottom stripping in 18" layers
Dumped riprap
±15' at El 5330
2.8:1
3:1
2:1
El 5410
Gravel fill
8:1
1.5:1
El 5350
El 5330
Upper cofferdam
River bed
115
90
85
El 5278±
7:1
Material stripped and placed below axis
Sand, gravel and boulders
Drain hole
Lower cofferdam
Rock line
Upper cut-off wall
Tensleep formation (sandstone)
Rockfill from excavation or borrow
Grout hole
Amsden formation (Limestone)
Lower cut-off wall
Maximum Section

numerous hot springs rise into the river. The dam has been located at the lower outlet of the canyon, where it will abut against walls of fine-grained sandstone or quartzite, only the upstream toe being within the limestone zone.

The dam will raise the level of the water 170 ft. to El. 5500 for diversion to the main supply canal through headworks located about 1 mile to the west of the dam. The canal system comprises 106 miles of main canal and 32 miles of lateral canal. The former will have an initial capacity of 1,200 sec.-ft. and will require the construction of about 4 miles of concrete-lined tunnel and a number of reinforced-concrete siphons, cross-drainage structures and wasteways. Contracts for the first 3.6 miles of the main canal were let in March of this year.

Seminoe Dam

Seminoe Dam is to be built in Granite Canyon of the Seminoe Mountains, about 65 miles southwest of Casper and 33 miles northeast of Rawlins, Wyo., and a few miles above the upper end of the Pathfinder Reservoir. Diamond-drilling at the site of the dam was begun in December of last year to supplement the studies made by the Bureau of Reclamation in 1931, and in June of this year contracts were let for the construction of a 4½-mile road to provide access to the site, in the hope that construction of the dam could be begun this fall. This road work was completed in November.

Designs for the dam have been ready since early fall but have not been advertised for construction because of the water-rights dispute. The [illegible] all for a concrete-arch dam abutting against sound granite. The dam will raise the level 185 ft. to El. 6350, creating a reservoir with a capacity of 1,000,000 acre-ft.

Power for the construction of this dam and for the construction of the Alcova Dam has been brought from the substation of the Mountain States Power Co. at Casper, a distance of 66 miles, over a 66,000-volt transmission line, which, upon the completion of the Seminoe project, will be used to connect the Seminoe power plant with the power system of the region. It is now in use by contractors at Alcova Dam building the tunnels and headworks for the first part of canal.

A hydro-electric power plant is to be built at the downstream toe of the Seminoe Dam and is to contain generators totaling 38,400-kw. The plant is expected to produce a uniform output of 18,100 kw., or about 150,000,000 kw.-hr. per year.

The Seminoe Dam is estimated to cost $3,750,000, the power plant $2,280,000, and the transmission line $2,365,000.

Assuming the power market as being found in Casper, the Platte Valley, Green River and Cheyenne, the average cost per kilowatt-hour of delivered power is estimated at 4.2 mills.

Proponents of the project believe that the power can be used: (1) to take up the normal increase in demand on the existing power systems; and (2) for exploitation of the natural resources of the district. It is stated that the undeveloped mineral resources of Wyoming include many alloy ores that are now imported in large quantities from foreign countries.

SEMINOE DAM is to be a concrete structure built in this granite canyon. The crest will be somewhat above the center of the picture.

The Pathfinder Reservoir (capacity, 1,070,000 acre-ft.) must be operated to meet immediate irrigation demands. Its storage ordinarily is withdrawn from early July to the end of September of each year. The Seminoe Reservoir, on the other hand, can be operated to meet power demands because water discharged through its power plant can be retained in and redistributed from the Pathfinder Reservoir. Over and above dead storage and 60,000 acre-ft. of the Seminoe Reservoir capacity that must be set aside to maintain a minimum power head of 93 ft., the remaining live storage of the two reservoirs thus becomes available for irrigation.

Employment created

Contracts now being completed amount to $1,000,000. As stated, no further contracts have been advertised. The employment created by the project at the peak this season amounted to 700 men; on Oct. 9 the working force totaled 550; it is expected that 475 will be employed throughout the winter season.

Possible plant poisoning

Recently a sensational chapter was added to the complex story of Casper-Alcova by the claim of some geologists and soil chemists that the shale rock and shale soil in the project area carries selenium, and that therefore the vegetation grown on the land might be poisonous. Intensive investigation of the questions involved has been carried on for several months, but to date no final settlement of the issue has been announced.

Selenium, close chemical brother to sulphur and apparently capable of replacing it in some organic compounds that normally contain sulphur, occurs in some shales of the northern Great Plains. For a long time restricted areas in South Dakota have been recognized as being injurious to cattle grazing on their vegetation. The effect was often called loco-weed poisoning, or "alkali" poisoning. A few years ago the soils of these areas were found to contain selenium, known to have cumulative poisoning action.

Still more recently it was discovered that a very few plants have the power to assimilate selenium from its inorganic soil compounds and bring it into organic combination, and that when so transformed it can be taken up by many other plants. If the weed plants that absorb the inorganic selenium can be eradicated from the cultivated area, harmful effects are believed to be forestalled. Further, organic selenium deposited in the soil by these weed plants can be leached out by irrigation.

These are tentative conclusions. Until they are confirmed and the whole issue is placed on an assured basis of agricultural security, the prospects of the Casper-Alcova project remain under challenge for other than dollars-and-cents reasons.

The TVA, an Experiment in Regional Development

The Tennessee Valley Authority, established by Congress primarily to put the power and nitrate plants at Muscle Shoals into operation and to sell power and fertilizer, takes up development of the Tennessee River Basin

COORDINATED regional development for an area of about 42,000 square miles in seven Southeastern states is the underlying purpose of the Tennessee Valley Authority. This vast experiment in regional planning was made possible by an act of Congress creating the Authority and directing it to proceed with certain specific activities. A dam, to create a great storage reservoir at Cove Creek on the Clinch River in east Tennessee (Norris Dam), was ordered built. A transmission line connecting Wilson Dam (Muscle Shoals) with Norris Dam was specified. Generation, distribution and sale of electrical energy were required, and construction of other power plants was authorized. Manufacture of fertilizer also was a definite stipulation. Later, by executive order, the construction of Wheeler Dam was included in the specific projects.

These tangible undertakings, except Wheeler Dam, received almost exclusive attention by Congress in consideration of the act setting up the Tennessee Valley Authority. Most of the act, in fact, is devoted to them. Nevertheless, what has transpired since the act was passed has shown that the most important part of the act is a brief section giving the President power to make such surveys and plans as are required in order to report to Congress upon the development of the Tennessee Basin, and to make such studies, experiments and demonstrations as are necessary to the preparation of the plans.

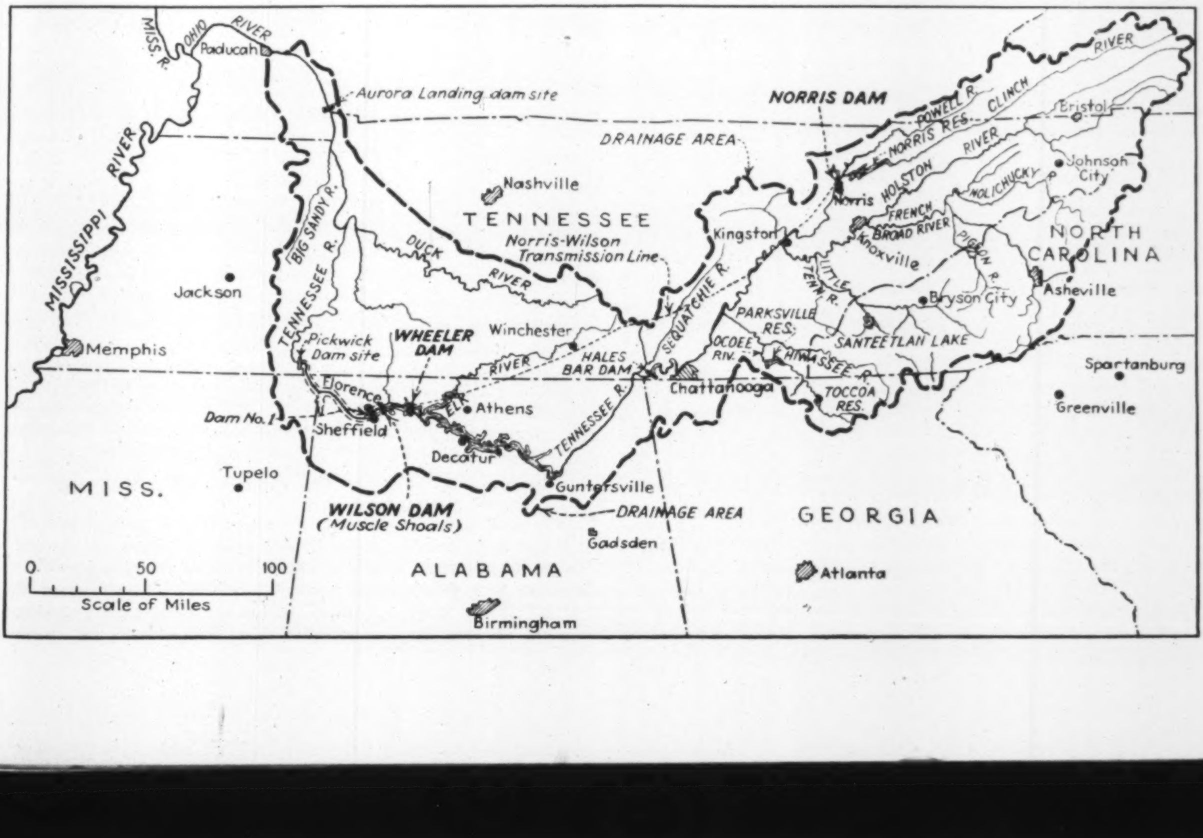
There is no doubt that President Roosevelt held these broader aspects of the project in the foreground in his consideration of the preliminary drafts of the act, being determined to see whether regional coordinated development could not be carried out as an adjunct to the power development and manufacturing experiments desired by the principal backers of the act.

The act gave the Tennessee Valley Authority the power to issue bonds up to $50,000,000 to finance its operations, thus indicating that Congress contemplated a self-liquidating undertaking, but to date its operations have been financed, first by an allotment of $50,000,000 from the Public Works Administration, and subsequently by Congressional authorization of an additional amount of $48,000,000.

For years before the passage of the Tennessee Valley Authority Act proponents of government operation of the power plant at Wilson Dam had fought their battle with no real plan beyond wholesaling the power. These proponents had early rallied to their cause the leaders of farm organizations of the country, under the lure of making cheap fertilizer at Muscle Shoals. Navigation enthusiasts and flood-control advocates later came forward to help pass a Muscle Shoals government operation bill through Congress. Local real estate promoters also lent a powerful hand to the lobby.

Half a generation of bitter two-sided discussion of the merits and fallacies of government operation of the power plant at Muscle Shoals has left many erroneous opinions as to the potentialities of that project. With the present unregulated flow of the Tennessee River, the minimum discharge at Wilson Dam of 7,500 sec.-ft. gives only 50,000 kw. of firm power in the waterpower plant. By using the 60,000-kw. capacity of the adjacent steam plant of the government nitrate plant No. 2, firm power at Muscle Shoals under

THE TENNESSEE RIVER BASIN has an area of 42,000 square miles and includes much of Tennessee and a considerable part of Alabama, also small parts of Mississippi, Georgia, North Carolina, West Virginia and Kentucky. As the area subject to development by the Tennessee Valley Authority is not limited, its activities affect a large part of the Southeastern states.


MISS. R.
OHIO RIVER
Paducah
Aurora Landing dam site
NORRIS DAM
DRAINAGE AREA
POWELL R.
CLINCH RIVER
NORRIS RES.
Bristol
MISSISSIPPI RIVER
Nashville
TENNESSEE
BIG SANDY R.
DUCK RIVER
Norris-Wilson Transmission Line
HOLSTON RIVER
Johnson City
NOLICHUCKY R.
Norris
FRENCH BROAD RIVER
Kingston
Knoxville
PIGEON R.
NORTH CAROLINA
Jackson
TENNESSEE R.
SEQUATCHIE R.
LITTLE TENN. R.
Bryson City
Asheville
Memphis
Pickwick Dam site
WHEELER DAM
Winchester
PARKSVILLE RES.
SANTEETLAN LAKE
RIVER
HALES BAR DAM
OCOEE RIV.
HIWASSEE R.
Spartanburg
Florence
Chattanooga
TOCCOA RES.
Greenville
Dam No. 1
Sheffield
Athens
TENNESSEE R.
Decatur
Tupelo
MISS.
Guntersville
WILSON DAM (Muscle Shoals)
DRAINAGE AREA
GEORGIA
Gadsden
0 50 100
Scale of Miles
ALABAMA
Atlanta
Birmingham

present conditions can be increased to 110,000 kw. There also is 74,000 kw. of secondary capacity at Wilson Dam. After Norris Dam begins to function as a regulating reservoir the low flow at Wilson will be increased to 13,800 sec.-ft. and firm continuous hydro power will be increased to 90,000 kw. Norris also will in itself add 75,000 kw. of firm power. The combination of Wilson, Norris and the existing steam plant thus will provide 225,000 kw. of firm power. With the 32,000 kw. to be installed at Wheeler Dam, next above Wilson Dam on the main river, there will be a total of 257,000 kw. of firm power and a considerable amount of secondary power.

Potential additional power

Prior to the creation of the Tennessee Valley Authority, the Corps of Engineers, U. S. Army, had made a comprehensive survey of the water-power possibilities of the Tennessee River and its tributaries as one of the 308 Reports authorized by Congress in 1927. That report was abstracted in *ENR*, May 11, 1933, p. 579. It assumed that practically all the undeveloped water power of the Tennessee and its tributaries might be harnessed and that all the 139 individual power projects listed eventually would become part of a comprehensive system. On this assumption, possibilities of developing 2,300,000 kw. and more in firm power exist in the valley. This total did not include private plants already in operation nor did it include the remarkable potential power and storage capacity of the Little Tennessee River, nor those of the Ocoee.

Whether the TVA, had it been uninstructed by Congress, would have built Norris first or a reservoir on one of the mountain tributaries may at least be questioned. Norris is expected to increase the minimum power that may be generated now during record low water at Wilson Dam, as previously stated. It will also greatly improve the output at Wilson during the entire low-water period each year. This applies to all future run-of-the-river plants on the Tennessee. Norris will further help to maintain a higher navigation stage during periods of low flow in the main river above and below existing dams on the latter until such time as the stream is fully canalized.

Construction operations

Norris Dam is to be a gravity-section concrete dam 253 ft. high, built across a comparatively narrow valley of the Clinch River not far above its confluence with the Powell River. It will form a reservoir of 3,600,000-acre-ft. capacity. No navigation facilities are included as the dam is considered to be above the limits of economic canalization. Power is to be generated in a plant built immediately below the dam.

Original estimates for the project included $1,500,000 for a permanent construction camp, but instead of building such a camp at the dam the TVA has gone some distance away to a more adaptable site and has built the town of Norris, a model village of 360 permanent houses with paved streets, walks, sewers, sewage disposal and water supply adequate for a population of 5,000. Semi-permanent bunkhouses and mess halls have been built for accommodation of the single men and other workers on the dam not accommodated in houses. This village ultimately will be used as the nucleus of a light industry town. It has cost about $3,500,000, which is included in the $34,000,000 estimated cost of the Norris Dam project.

Closely associated with the Norris Dam operation was the construction of a heavy-duty concrete highway from the railroad at Coal Creek to the dam, a distance of about 5 miles, also the continuation of this road (as a standard highway) eastward from the dam and through the town of Norris, to connect with a main highway north from Knoxville, a distance of 16 miles.

Between Norris Dam and Wilson Dam construction of a 154,000-volt transmission line 228 miles long is well along toward completion.

Work on the dam at the Wheeler site was begun by the TVA in November, 1933, on orders from the President. The navigation lock at that site was well along toward completion at that time, its construction having been started by the Corps of Engineers before the establishment of the TVA. The dam is not high (70 ft.) but is nearly 6,400 ft. long. A power plant is being built in the easterly section of the dam.

The TVA also has built a demonstration plant at Muscle Shoals for the manufacture of phosphoric acid and phosphatic fertilizers at a cost of about half a million dollars.

Navigation

Building of Wheeler Dam assuredly was not in the original plans of the TVA for early construction. It was undertaken on executive order at a time when the unemployment situation was close to peak. The lock that is a part of this project had been placed under contract during the Hoover administration for similar reasons and was far advanced when the TVA assumed charge. Completion of the lock and dam will extend the 9-ft. navigation stage upstream for 88 miles. Wilson Dam already provides that stage up to Wheeler Dam.

Construction of a dam on the main river at Pickwick Landing, about 70 miles below Wilson Dam was authorized by the TVA on Nov. 21 as its next undertaking. With that dam finished, there will be a 9-ft. stage at all times from it to the head of the pond created by Wheeler Dam. An existing navigation dam (Dam No. 1), two miles below Wilson, will be submerged when the Pickwick Dam is built. Except during periods of low water there is a 6-ft. stage from the Ohio to the site of Pickwick Dam. The completion of the latter will thus provide that stage practically all of the time to a point near Guntersville, Ala., 361 miles from the mouth of the Tennessee. One more major dam at the head of the pool formed by Wheeler Dam would give a 6-ft. navigation stage to Chattanooga. To obtain a 9-ft. stage would require the construction of one or more dams below the Pickwick site.

Possible Power Output

FOR THE PRESENT the Tennessee Valley Authority has planned to install only one of the eight 32,000-kw. generators for which space is provided in the power house of the Wheeler project. When Norris Dam is completed, the flow of the Clinch River below that point can be completely regulated and the low flow of the Tennessee will be sufficiently increased to permit the Wheeler unit to be operated to capacity at all times.

The Authority estimates it will have available when Norris and Wheeler dams are finished early in 1936 an output of 1,400,000,000 kw.-hr. per year in continuous power. This is on the basis of installed capacity of 100,000 kw. at Norris, 184,000 kw. at Wilson and 32,000 kw. at Wheeler, with the 60,000-kw. steam stand-by station as Nitrate Plant No. 2 at Muscle Shoals as an auxiliary.

Space in the power house at Wilson will permit the installed capacity there to be increased to 340,000 kw. With all the units in place in the power house of the Wheeler project, the capacity of that project will be 256,000 kw. By the addition of 60,000 kw. in the steam station at Nitrate No. 2, the TVA will then have from Norris, Wheeler and Wilson an ability to deliver 2,400,000,000 kw.-hr. per year of continuous power. Construction of additional storage capacity as contemplated on the Hiawassee River, and the proposed run-of-the-river plant on the Tennessee at Pickwick Landing would step this total up to over 3,000,000,000 kw.-hr. of firm power per year.

Disposition of this vast amount of power at rates that will carry operating expenses and capital charges on the investment involved is one of the major problems of the Authority.

The question of power costs

At this point there arises the difference of opinion between private utility engineers and those favorable to the power "yardstick" program of the Administration on a vital policy: What constitutes the investment for power generation purposes, or what part of the total investment ought to be charged to power development, and what to other features of the program, particularly to flood prevention, navigation and reduction of soil erosion?

Benefits from flood prevention and from improved navigation are to some extent subject to valuation. Even in these factors so much depends on the future development of the valley that only hypothetical figures may be established. When it comes to the commercial value of such intangibles as elimination of soil erosion, reforestation and similar benefits that come from any power-development program carried out on a sound permanent basis, the room for differences of opinion widens. But even without giving weight to these intangibles, from carefully prepared estimates the TVA believes that it can justify its power program at the very low rates it has established, if a market can be found. Other estimates indicate that a market for power may be developed in the valley and contiguous areas, a market that will absorb the output of the public power projects that have been authorized.

Taking first the probable future market in the area for power: the estimated future demands for hydro power in the seven Southeastern states are shown in an accompanying table. These estimates were based on consideration of existing residential, commercial and industrial consumption in the area. They do not take into account the great stimulation of growth in the demand for power expected from TVA promotional efforts. They were projected from the trend of growth during the last fifteen years, with an assumption of recovery to normal business-activity levels.

In the table, the total power market has been reduced by the amount of energy to be supplied by steam and also by the existing hydro-electric installations. The remainder represents the additional hydro requirements. The latter are expected to be supplied largely by developments on the Tennessee and adjacent rivers.

Work in the river bottom at Norris Dam has been pushed during the past summer in order to be out of the river before high water. Two penstocks that are to pass through the dam to the power house are shown at the left center.

ESTIMATED FUTURE DEMAND FOR HYDRO-ELECTRIC POWER IN SEVEN SOUTHERN STATES
(In Billions of Kilowatt-Hours per Year)
Estimated in September, 1934

Year	1937	1942	1947
Estimated total market	11.8	15.0	18.5
Less steam supply	2.4	3.0	3.9
Estimated market for hydro	9.4	12.0	14.6
Less present hydro capacity	6.4	6.4	6.4
Net additional hydro requirements	3.0	5.6	8.2
Net additional hydro requirements as per cent of present capacity	47	83	128

These totals the TVA considers conservative in the light of recent experiences in increased residential use of electricity resulting from the lower rates that have been put into effect in some parts of the valley and in the contiguous areas. Up to now the Authority is serving only limited areas in which its low rates are effective. Private utilities operating in most of the valley and wide areas of contiguous territory, however, have made heavy reductions in their rates for household use. At the same time the Authority has sponsored a very effective campaign to obtain reduction in the cost of electrical appliances for home use.

None of the private utilities have made public the detailed results of this recently created combination of low rates and low-cost appliances in increasing their domestic load. However, their sales of heavy appliances that are known indicate a greater growth in the use of electricity in the homes affected in recent months than had occurred in many years previously.

The president of the Commonwealth and Southern Co. (the holding corporation of the Georgia Power Co., the Alabama Power Co., and other Southeastern utilities that have put into effect reductions in domestic consumer rates sufficient to enable them to take advantage of the TVA low-price appliance and financing plan) recently stated: "The sales of appliances (of the Commonwealth and Southern) during the first eight months of 1934 reached the unprecedented total of $7,128,179, of which about 80 per cent were on the deferred-payment plan. This has greatly increased the residential use of electricity. In August, 1934, such use was 24.77 per cent greater than in August, 1933, but owing principally to rate reductions and to some extent increased use in the lower steps of the rate schedules, the receipts from residential customers were only 7.51 per cent greater."

He also added: "The system has a large excess of generating and distribution capacity and can take care of a greatly increased business with very little increased capital or other costs."

From this it appears that a remarkably large additional total of electric energy may thus be sold at rates that will show a reasonable return on plant investment not now earning anything.

Consumption increasing

Experience of the TVA in the application of its low rates and low-cost appliances is too limited to draw any valley-wide conclusions as to the probable rate of growth in the domestic consumption of electricity. However, figures on energy sales kept over a period of several months since the TVA low rates became effective in Tupelo, Miss., and Athens, Ala., may be taken as indicative of what may happen over the Tennessee Valley as a whole. Tupelo and environs form a community of about 9,000 people, with an approximate balance between industrial and agricultural support. There is far more local drive than is common in Southern towns of this size. Athens is a strictly agricultural community of about 6,000 people in which there is less aggressiveness. Previous to making a deal with the TVA for power both these towns bought energy from a private utility for public distribution.

In several months the total residential consumption in Tupelo increased 118 per cent. Taking the average residential consumption in the United States as a whole at 100, Tupelo at the beginning of this period was on a basis of 82. By the end of September this ratio had increased to 175, with the rate of increase accelerating. Meanwhile the commercial load had grown over 79 per cent, and industrial use had turned up even more.

In Athens only four months had elapsed up to the end of September in which to make comparisons with the immediately previous period. During this time the total residential consumption increased 100 per cent, and the commercial use was up 45 per cent. There is limited industrial load.

According to the TVA, operating expenses at Tupelo, exclusive of power purchased, have not increased in proportion to the increase in revenues. Power purchased at wholesale from TVA has been bought at gradually lowered average rates, due to improvement in load factor and to the larger volume of consumption. Volume of sales increase has raised the net available for fixed charges accordingly.

The TVA maintains that in determining the rates charged for this power it included in its operating and fixed charges all those items that a private utility would properly have to bear.

Whether the expenses of the Electric Home and Farm Authority, a subsidiary of the TVA for the promotion of the household use of electricity and use on farms, are being charged to promotion has not been made public. There also are various other items that may need to be taken into account in the long run. Meantime, it appears that TVA low rates and low-cost heavy electrical appliances, such as refrigerators, ranges and water heaters, may be expected to increase domestic consumption in the Southeast from 100 to 150 per cent. Commercial use also appears certain to grow somewhat similarly.

Industrial power

When it comes to possible increased industrial use of electric energy under the TVA program there are no definite grounds yet on which to base judgment. Prior to the depression the trend of certain great industries using large blocks of electric energy was definitely toward the South. In fact, in the last five years practically all the new chemical plants of the country have been located in that section of the country. Most of these have been at or near tidewater, but eventually through the development of navigation on the river the Tennessee Valley expects to have about the equivalent of tidewater transportation rates. Moreover, most of the basic raw materials for electrochemical industries are found in and adjacent to the valley. Numerous possibilities for electro-metallurgical industries also are to be found locally. Combining these industrial potentialities with very low-cost power appears to offer various probabilities for expansion of manufacturing lines that will be consumers of great blocks of energy. The TVA has not indicated how low it will go in rates for such industries. It seems entirely safe to conclude that energy might be bought by them as low as 3 mills per kilowatt-hour as a base rate. Certain lines of production that might take much of their requirements during periods of floodflow in the river could expect even more favorable rates than this. Certainly TVA will have a vast amount of energy to sell, and any income that will help meet fixed charges is better than none. Private utilities in the Southeast sell power to one another at 2 mills and less.

Fertilizer manufacture

The Tennessee Valley Authority recently has placed in operation at Muscle Shoals a large plant for manufacturing phosphoric fertilizer. Little has been made public regarding this phase of the Authority's activities. There appears, however, reason to believe that the TVA fertilizer program will eventually be worked out to benefit that industry as well as the farmers of the Southeast.

Planning Activities

THE RANGE OF PLANNING required in such a program as has been undertaken covers practically all private and public activities. In summarizing this planning it is essential that the basic conditions in the valley be remembered.

With its 42,000 square miles, the Tennessee Valley ranges in elevation from about 300 to over 6,700 ft. Climate and crops vary accordingly, with crops ranging from cotton and other south-temperate growths to those comparable to southern Canada. Rainfall is heavy over the entire valley, annual totals being from 50 to more than 80 in.

Population is relatively scant, the average being less than 50 per square mile. Of the 2,000,000 people in the valley more than two-thirds are rural. The largest city has less than 150,000 population. Industrial development is limited to numerous small plants, with textiles, woodworking and iron-finishing the most important. Except in part of the cotton country, individual farms are small and agricultural exports are limited. As a matter of fact, some areas in the valley import food and feedstuffs extensively.

Out of some 26,000,000 acres in the valley probably 16,000,000 are suitable only for timber growth. No accurate figures are known of the availability for agriculture of the remaining 10,000,000. Reliable estimates indicate that more than 3,000,000 acres are submarginal. If this minimum be taken as a correct total, it would leave 7,000,000 acres that may be used for a reasonably permanent system of agriculture. Practically all commercial crops may be grown at one place or another in the valley. The valley not only can support well a much larger rural population than now occupies it, but may also produce many highly specialized crops for export to other sections of the country. Taken as a whole, however, this is not a region of rich agricultural promise.

After a civilized use of less than 150 years, vast areas of the farmlands of the valley have been rendered unfit by erosion for further cropping. A pitifully large proportion of these eroded lands cannot be reclaimed for agriculture at reasonable cost. By heroic effort most of the land may be restored to timber. But erosion of these lands must be stopped at all events, or complete silting of reservoirs will result.

Unless methods of farming are adopted that will prevent further loss of soil, the valley also cannot maintain even the rural population now in it. Hence, proper agricultural planning becomes one of the outstanding features of the program of the TVA.

Into such agricultural planning is being fitted the fertilizer-manufacturing program of the Authority. Ample supplies of nitrogen were recognized to be available in this country. Certain crops also will give the land the nitrogen needed. Potash cannot be produced in the valley in competition with other sources. This left only phosphorus, of the three essential plant foods, that the Authority might make available at lower cost to the farmer.

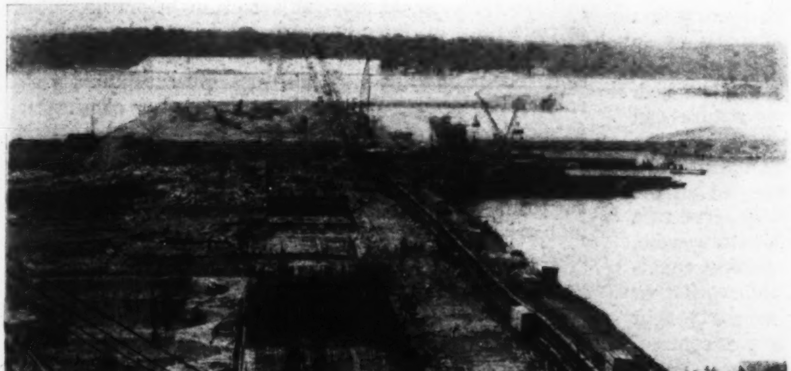
Extensive deposits of phosphates are available in and adjacent to the valley. Practically all valley soils greatly need phosphorus. Low-cost electric power also offers the possibility of producing phosphoric fertilizers by new methods at greatly reduced costs. This phase of the TVA program bids fair to consume large blocks of power. Success in cutting the cost of phosphoric fertilizer to the valley farmer is certain to improve agricultural conditions immeasurably. At the same time much reduction in soil erosion will automatically result from more pastures and more cover crops will thus be made practical.

Though the TVA expects to be able to offer exceptional opportunities to many industries, it has no idea of developing great industrial centers. Its regional planning parallels the trend toward decentralization of industry that was evident nationally before the depression. In fact, one of the outstanding objectives of the Authority is to obtain a balanced agricultural and industrial development throughout the valley. Small industrial centers, with the employee living largely in the surrounding farming areas, are a primary goal of its regional planning.

The Tennessee Valley Authority has proceeded with caution in its attack upon these numerous and involved problems of planning for a far-flung area that includes such widely different climatic, soil and social conditions. As a result, it has undertaken nothing on a regional scale other than its program of promotion of a great increase in the household use of electricity. Nevertheless, the Authority has undertaken numerous local demonstrations to improve the standards of living in the valley. These include both industry and agriculture, with correction of soil erosion and improved methods of farming as outstanding features. Forestation also is being stressed. All these undertakings will be closely coordinated.

Soil-erosion prevention on the watershed of the Norris Dam has been carried forward with more than 5,000 CCC boys. The TVA also is cooperating closely with the state and federal agricultural authorities operating in the valley to the end that better methods of farming may be practiced and soil erosion reduced. From the experience already gained much encouragement for economical means of checking soil loss has been obtained.

In reforestation work TVA also has worked closely with state and federal agencies. Outside a few areas adjacent to dam sites, little tangible forest work has been done. But valley-wide surveys of forest conditions are being made. From data thus obtained plans are being made as to the areas that should be devoted to permanent forests, how these areas should be handled and other general policies. Meanwhile, the nurseries are being started. A commercial nut-tree campaign has also been undertaken, with results already obtained.



POWER-HOUSE SECTION of the cofferdam at Wheeler Dam. The deep-rock excavation at the left is for the draft tubes of the turbines; in mid-channel is a second cofferdam, and on the far shore is the navigation lock.

Economic justification

In summing up the situation as to the probably economic justification for the whole Tennessee Valley Authority program, it is necessary to realize that such a broad program will require many years of experience before enough of a showing may be made to permit conclusions to be drawn. When it comes to the economics of the power program some time also will be required before it can be determined whether this phase of the vast experiment may succeed. However, the promotional program already has demonstrated that low rates and low-cost appliances will greatly increase the domestic and commercial use of electricity in the Southeast. If the standard of living in the valley may be improved to the extent that a larger percentage of the population may take advantage of low-cost power and electric appliances, then the increased volume of power that may be sold to domestic users far exceeds any totals that past experience in the area has indicated. Whether the rest of the load may be obtained from industries in lines that require great blocks of low-cost power remains to be demonstrated.

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A Straw Vote

TO VENTURE an advance guess, code financing will be the most insistent question to come before the Construction Code Authority meetings at Knoxville next week. Present indications are that registration-fee income is too small and its distribution too unequal to permit of truly effective code administration in this highly dispersed industry. Even with an approach to full registration, this condition indicates a most serious problem for the code administration; unless it can be solved, the feasibility of code operation will undoubtedly come into question rather soon. But though this is a most insistent question, it is not the most important, for early returns from a straw vote among contractors on the operation of the construction code show 70 per cent unfavorable; this points to so large an amount of dissatisfaction that its underlying causes should at once be searched out and remedied. The construction code, which in its very nature can never be a punitive law, depends more than any manufacturing code on voluntary support. This in turn means that it must operate to the advantage of all the parties concerned in construction and thereby serve as a medium of unification. According to the straw vote, however, three out of four believe that working conditions have not been improved for either the worker or the employer, while there is an even larger overweight of opinion that the code is detrimental to the contractor's business. If fuller inquiry confirms these pessimistic results, the construction code as it is can hardly survive. The Knoxville meeting, therefore, faces the primary question of making the code more useful and beneficial to contractor, worker and client of the construction industry.

Too Many Stop Signs

THE MOTORING PUBLIC is not entirely to blame for the widespread disregard for "stop" signs that is found today; part of it rests directly upon the shoulders of the state highway departments for their too close adherence to the letter of the rules that they have laid down for the placing of such signs. The rule calls for a stop sign where a secondary road enters a main road or where one main road joins another upon which traffic has the right-of-way. The need for a stop at such intersections under most circumstances is so obvious to all but the most careless driver that its instruction is obeyed quite generally. But not infrequently stop signs are found at points where the intersecting road comes in at a small angle to the line of traffic with which the incoming cars must be integrated and in full view from either line. To require the incoming cars to stop under such circumstances is so patently unnecessary as to make disrespect for the sign almost universal. A "Slow—Intersection" sign well back of the intersection to warn the approaching motorist would serve both traffic and safety needs better. Highway departments should place their traffic control signs by the rule of reason rather than by rule of thumb, if they wish to inspire respect for them.

An Impediment Removed

A TARDY REFORMATION IN POLICY as to relief-labor payments has just been accomplished by the Federal Emergency Relief Administration in discarding its long-standing rule that fixed zone wages must be paid. The new rule allows the local authorities to fix wage rates, the prevailing local rates to be the guide. Thus it adapts the work-relief system to the varying wage level of different parts of the country. The new order removes a real conflict of relief with recovery, for especially in the South the high relief-labor wages demoralized industrial and agricultural labor markets, besides having (together with the high PWA wages) a depressing influence on construction. It is fair to ask at this stage whether the new order goes far enough, and whether it is not imperative that relief-labor rates be so adjusted as to encourage, rather than merely refrain from discouraging, normal employment in the industries. Relief rates should be fixed at a margin below prevailing or code rates in order to exert a steady pressure toward increase of normal employment. With such a provision relief activities must also observe scrupulously the rule of performing no functions that are or can be performed by existing businesses. In both respects the management of relief has frequently been at fault; yet if we would avoid perpetuating relief, we must be careful to make every condition favorable to resumption of industrial activity to the point where relief can be abolished.

Constructive Trends

REVISION OF RELIEF-LABOR RATES forms part of what appears to be a general movement of current recovery planning in the direction of sound reconstruction. The past month's developments have been clarifying in this regard. Taken as a whole, from the election onward they point to increasing coordination of the public-works and private-works phases of recovery activities—a sane and constructive trend that contrasts with the previous disconcerting trend toward interferences between the two necessary parties to recovery. One vital phase of the realignment of thinking is the emphasis now being placed on rousing industrial construction out of its apathy; even while plans are making for vigorous continuation of public-works construction, there is a sudden appreciation of the accumulated deficit in expansion and improvement of industrial plant. Much of this cannot be mobilized for present use, of course, but must wait on a direct pressure of new business demand. But not a few large industries have both a reservoir of deferred improvements and an adequate surplus of resources with which to carry them out. To go ahead with these improvements is but to heed the exhortation contained in the President's recent address to the bankers, which appealed for initiative action based on confidence in the future. Now that substantial opinion has swung away definitely from relief devices, there is every reason for expecting constructive methods in place of measures of expediency that are more likely to demoralize than to rebuild.

Power Controversy and Policy

THREE EVENTS of the past few days serve to draw attention anew to the power-development and power-sales promotional work of the Tennessee Valley Authority. These are (1) the President's visit to the Tennessee Valley and his comment there on power matters, (2) approval of construction of a dam at Pickwick Landing, another source of power when needed by the TVA, and, (3) announcement by the Edison Electric Institute of its purpose to work for a test of the constitutionality of the act under which the government is building power plants to compete with private industry.

Confident that the market for electric power can be greatly expanded by low rates, the TVA has gone ahead with its program of power-plant construction. Selling power at rates much lower than those in effect in the region that it hopes to serve and supplementing its development work with an aggressive campaign to sell electric equipment, it has not only expanded its own sales but also brought about a notable increase in domestic power sales by private utilities, as noted on p. 705 of this issue.

That the TVA will not be deterred by the threat of the Edison Electric Institute appears obvious. Even though the Institute should find some way to have the Tennessee Valley act declared unconstitutional, such a result would not eliminate the existing Muscle Shoals power, and the Administration could go ahead with construction of Norris and Wheeler dams through the Corps of Engineers, which is building Bonneville Dam on the Columbia. Under these circumstances—and in the light of what the president of the Commonwealth & Southern Corp. said recently about the increase in sales by its subsidiaries—it would appear that the Edison Electric Institute might better direct its energies toward developing new and greater markets for electric energy rather than toward attacking the constitutionality of the act under which the TVA is building its new power plants.

The conclusion that emerges most prominently from current developments in the power field, however, is the immediate need for a clearly defined, stable and sound power policy. The present uncertainties arising from the complex relations of public and private power and of public power enterprises among themselves make the situation so chaotic as to prevent any consistent business planning.

Engineering News-Record holds no brief for either public ownership or private utility administration; it does, however, believe in fullest, cheapest and most businesslike power service to the entire community. In this view it holds to the conviction that immediate establishment of sound and uniform power policies by the government is essential to avoid confusion and misdirected business planning.

In any such policy, capital cost determinations must of course be honest and complete, and costs of operation must be computed equitably. Since the government enterprises are of regional rather than local size, and thus necessarily require network distribution, it is essential to decide whether network rates shall apply everywhere, and what shall be their regional extent. And, unless the government power participation is intended to destroy the private power business rather than cooperate with it, principles must be established that will prevent economically unsound competition even for development and promotional purposes.

The government has entered so deeply into the power-generating business that it is unlikely to turn back. Boulder Dam, the TVA and the Columbia River plants are bound to be applied to the service of the public. Their best function is to improve and promote power service—of the existing systems as well as of the new systems. They cannot do so until a sound and lasting policy is laid down.

Waterway Service Charges

THAT the St. Lawrence project will be laid before the coming Congress for approval after defeat of the treaty in the last session now appears certain. Fair consideration of the project will, we believe, include attention to the fact that the urge for it is essentially political and that an economic justification for the project has not yet been provided. Back of this fact lies the superficial way in which waterway economics are traditionally dealt with.

Transportation tolls to reimburse the cost of the waterway have not been mentioned in any discussions of the subject. Yet it is impossible to overlook the increasing recognition of the principle that transportation of every kind should pay compensatory service charges, a principle now established in every field except that of waterways.

Can any reason be advanced why the users of a new waterway should be exempt from the capital charges that railway traffic must pay, or from the rental or toll charges that are levied on highway users? Whatever is the logic of unrestricted and free traffic over national waters, there is no inherent right to free navigation over a new canal system or even a canalized river. Every reason of economics and good business sense argues, moreover, that if the new facility is profitable to traffic—and it is built only on the ground that there will be a profit to traffic—a fraction of that profit should be collected to amortize the capital invested in the improvement.

And finally, in proper navigation accounting it is important that the full cost of the improvement be computed, and that the service charges be based thereon. Canal costs notoriously involve many expenditures that are not paid by the government, such as the cost of bridge and highway changes; in some cases these other costs are far larger than those involved in the excavation of the waterway itself. They form a rightful part of the actual investment of the waterway, and until they are included in figures of waterway costs and returns a correct understanding of waterway economics will not be obtained.

True accounting to determine the cost of the service offered to traffic, and collection of charges to cover this cost are prime essentials in reformation of waterway transportation thinking. The St. Lawrence project, because of its size as well as its national and international importance as a waterway improvement, demands their consideration in order that it may be based on honest business thinking and in order to help dispel the economic doubts that now surround it. After the enterprise is thus placed on a sound basis, the other problems that it presents should be found capable of more ready solution.

CURRENT NEWS

Problems of the Code Will Be Aired at Knoxville Meeting

REPRESENTATIVES from all branches of the construction industry will meet in Knoxville, Tenn., Dec. 5-8, for important meetings of the Code Authorities and conferences between contracting and producing interests. The program arranged by the Construction Code Authority and the Construction League contains features looking toward the further integration of the construction industry.

In scheduling the Knoxville meeting, the authority is continuing its general policy of holding meetings outside of Washington so as to focus the interest of various sections of the country on code problems and to gain from the experience of members of the industry in such localities. The initial meeting, Dec. 5, will be an open session where questions may be freely asked and an opportunity presented to bring to the attention of code officials the administrative problems which are perplexing the local industry. The chief topic of discussion will be code compliance.

Emphasis on compliance

The emphasis which the code authority is placing upon the subject of satisfactory code compliance and enforcement at this meeting is particularly significant following the recent NRA announcement of the creation of ten regional compliance boards to which will be referred for final action the compliance cases from the existing state and local compliance offices, instead of referring these cases to Washington. The regional director will either settle the case or refer it to a regional council of three—one representative of industry, one of labor and the chairman who will be an attorney on the staff of the litigation division. A litigation specialist, in conjunction with the local district attorneys will be responsible for immediate action on complaints which the regional councils refer for active prosecution. The regional councils will be vested with the authority to remove code Eagles for wage and hour violations.

On the second day a conference of code officials and trade association representatives is expected to be the first of a series of such meetings for those interests which produce construction material.

There will also be sessions of the Construction Code Authority, the Divisional Code Authority for General Contractors and other divisional code authorities as well as meetings of local administrative committees of the several groups for conference and instruction. On the closing day a trip will be made to the TVA projects at Norris, inspecting the dam and the low-cost housing construction in the town.

The National Construction Planning and Adjustment Board also plans a meeting to determine a plan for regional boards and for labor compliance procedure throughout the industry.

PWA Will Restudy Allotments For Work on Louisiana Projects

As a result of the legislation recently enacted at the special session of the Louisiana state legislature, Administrator Ickes has ordered a restudy of the PWA allotments for public works projects in that state. Projects which are already under construction will not be affected by this ruling. No additional PWA funds will be advanced to finance non-federal projects in Louisiana until the legal department of the PWA has opportunity to study the full effect of the new law in Louisiana which provides for a moratorium on the payment of debts and the other laws which might possibly affect the security and marketability of bonds offered by borrowers in Louisiana.

Milwaukee Seeks to Void Order Tying Up Fertilizer Revenue

Following an order by Judge F. A. Geiger tying up the revenue the sewerage commission of Milwaukee derives from the sale of Milorganite, the fertilizer made from sludge at the sewage-treatment plant, the city has filed a petition in the federal court for Activated Sludge, Inc., to show cause why the order should not be set aside. The order tying up the fertilizer proceeds was granted a week or more ago on the plea of that company, the holder of the patent on the activated sludge process which Judge Geiger ruled, in February, 1933, had been infringed by the city in the operation of its sewage-treatment plant.

Accompanying the city's petition were affidavits by James L. Ferebee, chief engineer of the commission, showing that there have been losses instead of profits on the handling of fertilizer and figures concerning budget upsets that will result if the court order stands. Mr. Ferebee asserted also that the processes employed in the fertilizer manufacture were invented by employees of the commission and that Activated Sludge, Inc., has no such patents.

The cost of handling sludge has been greater than the returns from sales for the past four years, it was said. The loss was put at $29,439 for 1930 and $238,711 for 1933.

McCarl Rules FERA Funds Cannot Be Used for Housing

Controller-General J. R. McCarl ruled last week that $400,000 allotted to the District of Columbia by the Federal Emergency Relief Administration cannot be spent for a low-cost housing development. It is the Controller-General's contention that there is no authority in the law that permits transfer of the funds to the District Rehabilitation Corp., a public body that had developed a housing project as an unemployment-relief measure. He cited particularly the expenditure of the funds for real estate as being contrary to both the spirit and letter of the law.

TVA Authorizes Construction Of Pickwick Landing Dam

The Tennessee Valley Authority has authorized construction of a $22,000,000 dam near Pickwick Landing on the Tennessee River in southwestern Tennessee. The new dam will raise the water level in the river 61 ft., backing it up to Wilson Dam (Muscle Shoals) and thus will provide a 9-ft. navigation channel from Pickwick Landing to Wilson Dam, and will submerge Dam No. 1, a small navigation dam directly below the Wilson Dam.

The new dam will have a total crest length of 7,710 ft., of which 5,600 will be formed by earth embankment and the remaining central section will be of concrete. The spillway will be 1,301 ft. long and will contain 26 roller type gates 40-ft. wide by 34 ft high.

Improvement of navigation, with incidental flood control, is the principal reason for this new unit of the TVA system of dams, although the ultimate plan calls for installation of six 34,000 kw. power units.

A navigation lock 600-ft. long by 110-ft. wide is included in the undertaking. It will have a single lift of the unusual height of 61 ft. There now is a 7-ft. navigation stage to above Pickwick Landing. With the new dam completed there will be a 7-ft. stage to Guntersville, Ala., a distance of 383 miles from the mouth of the river and a 9-ft. stage from Pickwick to Guntersville. With one more dam provided at Guntersville a 9-ft. channel would be available from Pickwick to Hales Bar, directly below Chattanooga, with a 6-ft. channel from this point to Chattanooga.

A crew of 60 men was immediately set to work at the site and TVA expects to increase its force to 200 within a short time. Purchase of land for the reservoir area will be started at once and reservoir clearing will follow immediately. The estimated construction period will be about three years.

Railroad to Grand Coulee Dam Ready for Use After Dec. 1

On Dec. 1 ceremonies marking the completion of the 30-mile construction railroad from the Northern Pacific tracks to the Grand Coulee dam site will be celebrated with appropriate ceremonies. The railroad runs through the Grand Coulee and did not present any unusual construction difficulties except near the Columbia River end where the descent into the canyon required some heavy grading and a switch back to reach river level.

The Mason-Walsh-Atkinson-Kier Co., contractors for the dam, have completed 90 houses and dormitory buildings during the past few weeks and dozens more are under construction. With the aid of a large trailer drawn by tractor, and using other tractors for braking power, two 20-ton transformers have been moved to the contractors' town site for the power station at the end of the construction transmission line.

Edison Institute Will Challenge Federal Projects

THE Edison Electric Institute, representing 80 per cent of the privately owned electric power industry of the country, has decided to challenge the federal government program of major power projects. At the last meeting of the trustees, resolutions were passed calling for a court test of the legality of the TVA program. According to Thomas N. McCarter, president of the institute and of the Public Service Corporation of New Jersey, an opinion had been obtained from Newton D. Baker and former Representative James M. Beck in which both lawyers reported that the TVA development was "palpably unconstitutional."

The trustees of the institute passed the following resolution:

> "Resolved, That the Edison Electric Institute is of the opinion that the public interest requires an early adjudication by the courts as to the merits of pending questions which involve the determination whether there are limits under the Constitution beyond which government may not go in using public funds to destroy by competitive construction and operation the existing investments of private capital in public utility enterprises, and it is further
>
> "Resolved, That the president or the executive committee of the institute are hereby authorized and empowered to take any necessary steps of co-operation in behalf of the early declaration and determination of the powers of government and the rights of investors as to competitive projects initiated by government, and are authorized to employ and consult such counsel, engineers and economists, and to take such further steps, as in their judgment may be necessary or proper to bring about a prompt adjudication and settlement of the matters in controversy."

The announcement of the institute immediately brought a reply from David E. Lilienthal, director of the TVA, which stated: "The mask is off. The few men in New York City who through the holding companies control the electricity supply of 130,000,000 people have stepped from behind the 'widows and orphans,' the preferred stockholders, the ice men and the coal men, and are now speaking in their own behalf.

"We now have, in the open, a clear issue between the people who use electricity and those who have controlled it."

Large Building Program to Start In Austin, Tex., Within Month

A building program aggregating $458,000 will be under construction within a month at Austin, Tex., according to the present plan of the city administration, as announced by Guiton Morgan, city manager. The work that will be started will include: water extensions $160,000, outfall lines for the new sewage disposal plant $100,000, sanitary sewer lines $175,000 and the new headhouse at the city filter plant $23,000. This will leave only the new $400,000 sewage disposal plant to be put under contract after Jan. 1.

Plans for Smaller District Units In St. Louis County Sewer Plan

Substitution of a number of smaller districts with boundaries based on natural drainage areas is being considered by community officials and PWA engineers in place of the St. Louis County Sanitary District program for which a bond issue of $5,878,000 was defeated on Sept. 25. PWA engineers, according to reports, consider the program of new sewer construction and drainage facilities urgent and favor a modified plan. The new program would provide tentatively a central drainage district to include Webster Groves, Glendale, Rock Hill, Brentwood and Clayton, with several separate smaller districts.

Bids Called for Taylor Park Dam To Cost About $2,500,000

Bids have been called by the Bureau of Reclamation for the Taylor Park Dam to be built on the Taylor River in Gunnison County, Colo., at a cost of about $2,500,000. The invitation for bids, to be opened Feb. 18, was issued in advance of the specifications to allow prospective bidders to visit the dam site while weather conditions permitted. Specifications and drawings will be available about Jan. 15.

The Taylor Park Dam will form an addition to the present Uncompahgre reclamation project in western Colorado, one of the first developments built by the bureau. The plan calls for alternate bids on either a concrete arch or earth fill type of structure to provide a reservoir capacity of 106,000 acre-ft. The released water will flow down the Taylor River into the Gunnison River and then through the existing tunnel into the Uncompahgre Valley. The PWA is financing the cost of the dam and the additional expenditure of about $325,000 for improvement of the distribution system and the lining of the Gunnison tunnel.

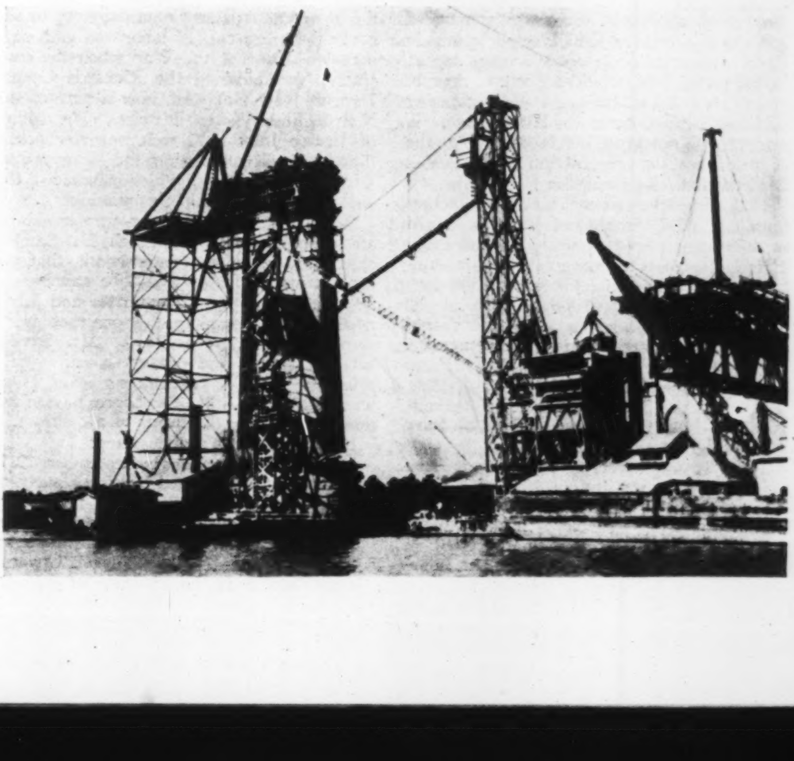
Texas Starts Survey Work On Brazos River Development

Following the passage of a bill in the Texas legislature creating a conservation and reclamation district embracing ten counties in the watershed area of the Brazos River, survey work has been undertaken by the state water board to develop data for an ultimate $40,000,000 program. This program would include the construction of thirteen dams providing flood control, water conservation and irrigation development on the Brazos watershed. Records for the last fifteen years show that this stream has damaged property to the extent of $90,000,000 and taken more than 400 lives in flood periods.

Financing of the program, according to the new law, is provided by the remitting of state taxes in the ten counties for a period of twenty years. There is hope that a federal financing program can be arranged based on the annual return from these taxes. Although surveys have started to provide detailed data on the conservation program, it may be several years before actual work will be started on the project.

COMPLETING THE LAST PIER FOR THE NEW ORLEANS BRIDGE

Substructure work for the combined highway and railway bridge across the Mississippi River above New Orleans is nearing completion and the last bucket of concrete is shown going into place in the top of the last of the four main river piers. The top of the masonry is 145 ft. above mean low water and the foundations go down 170 ft. below low water. The floating concrete plant, at the right, has a tower 120 ft. high. The bridge will have a total length of 23,000 ft. and a main river crossing of 3,525 ft. It is being built jointly by the state of Louisiana and the Public Belt Railroad Commission. Siems-Helmers, Inc., are the contractors on the pier work. Modjeski, Masters & Case are the engineers. A description of the bridge and of the sinking of the pier foundation through artificial sand islands was given in *ENR*, May 10, 1934, p. 589.



Plans Differ for Financing Program On Federal Housing

(Washington Correspondence)

NEED for coordination of the federal government's housing activities was indicated last week and President Roosevelt will probably take a hand in the matter.

Censuring private capital for failing to enter the housing field, PWA Administrator Ickes announced a proposal to extend his low-cost housing program to include construction of groups of low-cost homes by the government for sale to individuals on long term 3 per cent mortgages. By agreement with the building trades, hourly wage rates would be reduced with assurance of larger annual earnings from steady employment. Administrator Ickes also expects that large orders for building materials would win price concessions. William Green, of the A. F. of L., commented that a guarantee of steady employment would be worthy of consideration. Concerning the 3 per cent interest rate, the administrator argued that if private rates are too high, the government should make them cheaper.

Another equally sincere administrator, James Moffett, of the Federal Housing Administration, declared that "if the government is going to compete with private enterprise we might as well tear up the National Housing Act. If the act means what it says, it means that housing is a private enterprise."

Whether FHA's mortgage insurance system will succeed in tapping the big reservoir of loanable funds is still to be proven but the ideas expounded by the two administrators conflict primarily because one regards new housing as an emergency measure and the other considers it a long range program responsive only to a normal stimulus. FHA now is concerned primarily with protecting $21,000,000,000 of existing mortgage debt, stabilizing the values of 29,000,000 existing homes.

The extent to which government construction and sale of small homes (as distinguished from low-cost apartment housing for rental) would actually impair FHA's program of insuring private capital in the realty field, would depend, of course, entirely on its volume. PWA's housing division, Administrator Ickes says, is gearing to spend $2,000,000,000, but the scope of dwelling construction by PWA will be determined by President Roosevelt.

Following the recent airing of home-building plans, Administrator Ickes issued a formal statement strongly endorsing FHA's program to encourage private capital to return to home financing. Further, Administrator Moffett agrees that all the administration's housing activities should be cleared through some central agency. At present FHA, HOLC, RFC, Farm Credit Administration, PWA, FERA, TVA, and the Treasury, Interior, Agriculture and Post Office Departments all have a hand in housing.

FHA is now accepting applications from private lending institutions who wish to do business under its mutual mortgage insurance system. It is also pushing plans for insuring private capital interested in construction of low-rent apartment housing.

Sludge Incineration Approved For Chicago's Calumet Plant

Incineration for the disposal of sludge at the extension of the Calumet sewage treatment plant of the Chicago Sanitary District, as proposed by the district's engineers, has been recommended by the PWA Engineering Board of Review. The board also recommended the substitution of steam-driven pumps and blowers for electrically driven units at the proposed Southwest treatment plant.

While recommending the adoption of sludge disposal by incineration for the Calumet plant the board held that decision as to the advisability of combining incineration of sludge with steam generation of power at the Southwest plant should be deferred. In this connection it was recommended that a test of this combination should be made of the Calumet plant by installing a boiler at one of the incinerators. The use of steam-driven pumps and blowers, however, was held to be economically advisable, irrespective of the method to be adopted for sludge disposal.

"Under the circumstances, it is unnecessary and inadvisable at this time to make a definite decision as to the best method of sludge disposal for the Southwest plant. Design work on the pump and blower house of the Southwest plant can proceed without delay, design of the boiler room being deferred until an actual test, on a large scale, is made as to the feasibility and economy of combining incineration with steam generation," the report stated.

The recommendations were signed by the three members of the Engineering Board of Review appointed by Public Works Administrator Ickes: Daniel W. Mead, William B. Storey and Charles W. Kutz.

Pennsylvania Electrification Is 80 Per Cent Completed

With 11,200 men employed and a monthly payroll of more than $1,000,000, the program of the Pennsylvania Railroad for electrification of its lines between New York and Washington is more than 80 per cent complete and electric passenger train operation is planned for early in January. The second step of the program which will provide electric operation for all freight service is scheduled for completion shortly afterward; equipment for freight tracks and yards is nearly 50 per cent complete. The recent contract for 57 new streamlined electric passenger engines, to cost almost $15,000,000, is part of this general program.

Plans for 100th Commencement at Rensselaer Polytechnic Institute

Plans are under way for commemorating the one hundredth anniversary of the first award of degrees in civil engineering at the Rensselaer Polytechnic Institute, Troy, N. Y. Founded in 1824, the traditional academic degrees in arts were granted for several years, but in the spring of 1835 the degrees of bachelor of natural science (B.N.S., later B.S.) and of civil engineer (C.E.) were first conferred upon members of the graduating class. According to information from the institute, these were the first degrees in science and engineering granted in any English speaking country, making formal engineering education 100 years old at the time of the 1935 graduation.

Contractor Wins Old Claim for Damages On Rise of Costs During War

DAMAGES of $165,000 were awarded Nov. 13 to C. W. Blakeslee & Sons, Inc., New Haven, Conn., in their suit against the City of Hartford, Conn., and the Board of Water Commissioners to recover the extra cost of labor and materials occasioned during the War when the contractor was building the Richards Corner Dam at New Hartford, now a part of the Metropolitan Water District. The ruling of Justice John K. Beach, superior court, Hartford, will run against the Metropolitan District Commission which succeeded the old Board of Water Commissioners.

Action by the contractor was based on an alleged promise of Caleb M. Saville, chief engineer of the water board, that the contracting company would be reimbursed for the extra cost of materials and labor necessary to complete the contract work starting in September 1915. Mr. Saville further stated the water board would reimburse the contractors as soon as it was legally possible, the board having no power to change the terms of a contract.

In the finding, the court states:

"Conditions existing in September, 1917, were not contemplated by either party to the contract and were not reasonably foreseeable at the time the contract was executed. These conditions that did arise were imposed by the Federal Government, acting in the exercise of its war powers and that conditions existing at the time had already made the continuance and completion of the work at the contract price impossible, except at a cost, the amount of which was then beyond estimate and which turned out to be $165,163 in excess of the already inflated costs of March, 1917."

Justice Beach also explained the plaintiff made it clear he would discontinue work on the contract unless assured the additional cost would be paid. In September, 1918 the justice found representatives of the Blakeslee company and the water board held conferences regarding legislature that would make it legal for the water board to pay the added costs. In May, 1918 this special act was passed. Counsel for the board held this act to be unconstitutional but its validity was upheld by the Supreme Court of Errors.

Justice Beach also found that before completion of the work in December, 1918 the engineer had induced the Blakeslee company to continue and that the water board knew this fact and accepted the plaintiff's efforts, disallowing the plaintiff's claim for reimbursement under the mistaken belief the enabling act was void.

The interest on the $165,000 claim amounts to $142,000. It is expected that before final settlement is made, the case may reach the Supreme Court of Errors.

Court Approves Official Plan for Muskingum Conservancy District

Official approval of the $35,000,000 water development plan of the Muskingum Watershed Conservancy District in eastern Ohio was given by the Conservancy Court on November 19. This court, composed of a judge from each of the sixteen counties in the district, in accordance with the Ohio conservancy law, is required to pass on petitions creating the district and approve the plan before it becomes official. As a result of this court approval, construction operations can begin within the next few weeks as bids have already been received on several of the dams. The low bid on the first unit was $388,000 for the Tappan Dam which will be an earth-fill structure 1,400 ft. long and 35 ft. in average height.

The financing for construction of the dams, which will be carried out under the direction of the Corps of Engineers, is provided by $22,090,000 of PWA financing. The Ohio Department of Highways will undertake $4,000,000 of highway relocation work and the district and state will provide $8,000,000 for reservoir sites and easements. The history of the Muskingum Watershed Conservancy District and the flood control problems in the area were outlined in *ENR* June 21, 1934, p. 799. The units in the official plan, resulting from subsequent studies made by the Corps of Engineers were outlined in *ENR* Nov. 1, 1934, p. 563.

Local Wage Standards to Govern Rates of Pay on Work Relief

Fixed or zone-controlled rates of pay for work relief were abolished Nov. 22 by the Federal Emergency Relief Administration and the responsibility for pay standards was placed upon local authorities, either state administrators or boards representing various interests which functioned under the CWA a year ago. The order, issued by Relief Administrator Harry L. Hopkins in the form of a telegram to all state administrators, was interpreted as in line with recent federal policy of decentralization in relief administration and as emphasizing the tendency to enlarge the work relief program and diminish the direct relief rolls.

Mr. Hopkins' telegram read: "All previous rules and regulations governing minimum hourly rates of pay are herewith rescinded so that the prevailing rate in the community for the kind of work performed will be the governing factor in determining hourly wage rates hereafter." In brief this means that in the future relief work projects will not tend to drain private employment of its labor by offering higher wages than the private employment.

Bids Called for New Water Supply for Shawnee, Okla.

Bids have been called Dec. 10 for construction of a new water supply system for Shawnee, Okla. The work will include construction of an earth fill dam containing 480,000 cu.yd., 29,500 ft. of 27-in. (or larger) cast iron, steel or concrete pipe, 18,000 ft. of 20-in. pipeline, including the Canadian River crossing, and extensive improvements to the filter plant, pumping station and distribution system.

Rapid Progress Made on Trestles Crossing Mississippi River Spillway

CONSTRUCTION work on the four bridges being erected across the Bonnet Carre spillway near New Orleans has advanced rapidly, favored by mild rainless weather, and engineers predict that the projects will be completed before next April. Three creosoted pile, ballast-deck trestles are being built by railroads across this Mississippi River flood outlet and the Louisiana Highway Commission is constructing a concrete pile bridge.

The Yazoo and Mississippi Valley Railroad, subsidiary of the Illinois Central Lines, is building the trestle nearest the Mississippi River bank. This trestle will be 8,000 ft. long with 2,400-ft. earth fill approaches on both ends. Work has advanced to the point that permits placing of ballast. Riprap rock has been placed on the sides of the approach embankments inside of the spillway. Trains will be using the structure before February, 1935 according to present estimates.

Work on the double-track ballast deck trestle of the Illinois Central railroad main line near the edge of Lake Ponchartrain is also well advanced and completion of the project is possible by April 1, 1935. In addition to lifting the railroad tracks clear of Mississippi flood waters when the spillway is in use, the Illinois Central trestle will obviate any danger of inundation of the tracks during occasional tropical storms. This structure is over two miles long. The Louisiana and Arkansas railroad trestle, near the Y. & M. V. line, is being advanced with completion scheduled at about the same time as that set for the Y. & M. V. trestle.

Work on the concrete pile type of trestle being erected for the Louisiana Highway Commission is well advanced, according to N. E. Lant, bridge engineer for the commission. All of the piling for the bridge have been driven and about 25 per cent of the concrete bridge deck completed. The approaches to the highway structure, let under separate contract, will be completed by the end of December. After the approach fills settle from January up to completion of the structure next April, a temporary macadam surface treatment will be provided. This temporary paving will be replaced by concrete after a year's use.

Important Grade Crossing Ruling Made by Canadian Commission

An important judgment on the question of allocating the costs for grade crossing separation projects has been rendered by the Board of Railway Commissioners for Canada. The municipality of St. Eugene de Guigues, Quebec, requested a highway crossing be built over the Canadian Pacific Railway Company's tracks at Angliers, near the end of a long branch line. The railway company contended that the municipality should pay for the cost of this crossing as no highway existed at this point at the time the railroad was built. The commissioners did not allow this claim, in view of a provision which had been made for a highway in this location prior to the construction of the railroad line, basing their judgment on an old order of the governor of Canada which was issued in 1794.

Los Angeles Advances Plans to Purchase Local Power System

Plans of Los Angeles for acquiring the electrical generating, transmitting and distributing properties of the Los Angeles Gas and Electric Corporation in Los Angeles and Orange counties were reported formally to the California Railroad Commission on Nov. 20 in an application asking the commission to fix the compensation to be paid for the corporation's electrical properties. E. F. Scattergood, chief engineer and general manager of the Municipal Bureau of Power and Light, said the application is to institute proceedings for valuing the electrical system of the corporation, in conformity with the rights vested in municipalities by the state constitution.

The city's application to the commission follows the action of Los Angeles voters on Sept. 27 in voting amendments to the city charter designed to facilitate the acquisition of the corporation's electrical properties. The approved amendments include one authorizing the city to borrow from the state or federal government funds to acquire the properties, another authorizing the department of water and power to take over a part of the outstanding indebtedness of the corporation, and a third authorizing the department to retain all employees of the corporation in their respective capacities without regard to civil service requirements.

Contracts on 36 Public Buildings Awarded Oct. 1 to Nov. 15

Thirty-six contracts for public buildings have been announced by the Secretary of the Treasury and the Postmaster General for the period from Oct. 1 to Nov. 15 with plans nearing completion for 311 projects which will be out for bidding within the next few months. The total cost for the projects now in the drawing stage will amount to $49,513,456. Sites have been selected, topographical surveys ordered and preliminary drawing work started on 73 projects, for which the total limits of cost amount to $11,008,075.

Plans and specifications have been completed for 32 projects since Oct. 1, 1934, bringing the total to 166 projects costing $19,920,502.

It has been the aim of the two departments to arrange the program, which includes projects in 788 different communities, to have 90 per cent of the work under contract during the early part of the coming winter. The total amount available for emergency construction is $134,028,706, of which amount there is now under contract $39,145,998 as against $31,516,543 on Oct. 1.

The appropriation of $65,000,000 was made by Congress June 19, 1934, to alleviate unemployment in the building trades and allied industries. This appropriation was to augment the $67,000,000 authorized for public building construction under previous legislation.

Brief News

THE VIRGINIA Department of Highways has inaugurated a monthly bulletin to report developments in the department and print news of interest to contractors. H. J. Neale will be editor of the bulletin.

A SURVEY conducted by the Better Housing Committee of Buffalo, N. Y., indicates a prospective expenditure of more than $1,500,000 for home improvements.

ENGINEERS for the Willacy County Water Control and Improvement District No. 1, Texas, are preparing plans and specifications for an irrigation system. There is a tentative agreement for $4,853,000 PWA financing.

TO PROMOTE national and provincial financial aid for the construction of a $3,000,000 sewage disposal plant, Winnipeg, Manitoba, has proposed the appropriation of $25,000 for a study of conditions of the Red River and preparation of plans for a system of interceptor sewers and a disposal plant.

SOCIETY CALENDAR

AMERICAN ROAD BUILDERS, annual convention, Washington, D. C., Jan. 22-25.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York, Jan. 16-18.

AMERICAN SHORE AND BEACH PRESERVATION ASSOCIATION, annual meeting, Washington, D. C., Jan. 10.

CANADIAN CONSTRUCTION ASSOCIATION, annual convention, Montreal, Que., Jan. 29-31.

HIGHWAY RESEARCH BOARD, annual meeting, Washington, D. C., Dec. 6-7.

NATIONAL PAVING BRICK ASSOCIATION, annual meeting, Indianapolis, Ind., Feb. 7-8.

Obituary

WAYNE RAWLEY, vice president of the Blaw-Knox Co., and previously an engineer with both the Carnegie and the Cambria Steel Companies, died at Miami Beach, Fla., Nov. 16. He was 56 years of age.

EDWARD S. BOOKER, well known contractor in the Pacific Northwest, was killed while working in the engineering organization on the Bonneville Dam project. He was 72 year of age.

KENNETH H. RANKIN, concrete inspector for the Bureau of Reclamation on Boulder dam, died Nov. 14 in the Boulder City hospital as the result of injuries received when a loaded bucket of concrete crushed him against the form work during construction operations.

FRANK L. LOCKE, at one time a member of the civil engineering staff at M.I.T. and later in the city engineering department at Boston, died Nov. 23 in Cambridge, Mass. at the age of 69.

ROBERT A. FARMER, retired cadastral engineer and a veteran of 44 years of active service in the various surveying and mapping agencies of the federal government, died in Denver Nov. 16 at the age of 72. After attending the University of Tennessee, he worked on railroad surveys prior to joining the U.S.G.S. in 1888. He subsequently served in other government agencies on survey work and was retired in 1932 at the age of 70.

CONSTRUCTION STATISTICS OF THE WEEK

ENGINEERING award totals for this week have been closed one day early due to the Thanksgiving holiday, which accounts in part for the low total of $16,224,000. Of this total $2,456,000 represents federal awards, $10,158,000 state and municipal, $12,614,000 total public and $3,610,000 total private. The private awards exceed last week's total for this classification. The big drop from last week's high volume is in public buildings, $1,522,000 this week; earthwork, irrigation, drainage, $1,597,000; and highways, $5,640,000 for the four days included in this report. Increases over last week are reported in waterworks with a 4-day total of $930,000; sewerage, at $1,164,000; and commercial buildings at $1,997,000.

Only four large lettings are reported. They are: highways by New York State, $1,076,000; bridges by New York State, $660,000; dredging by Corps of Engineers, Indiana Harbor, 1,599,990 cu.yd., $598,000, and Whiskey Bay Pilot Channel, La., 6,500,000 cu.yd., $607,000. State and municipal bond sales totalling $4,791,000 make up the new capital total for the week.

CONTRACTS

(Thousands of Dollars)

	Weekly Nov. 1933	Average Prev.4 Weeks	Week Nov.29 1934
Federal Government	$10,554	$7,301	$2,456
State and municipal	14,238	18,366	10,158
Total public	$24,792	$25,667	$12,614
Total private	4,739	3,881	3,610
Week's total	$29,529	$29,548	$16,224

Cumulative to date:
1933......$966,003 1934.....$1,177,444

NEW PRODUCTIVE CAPITAL

(Thousands of Dollars)

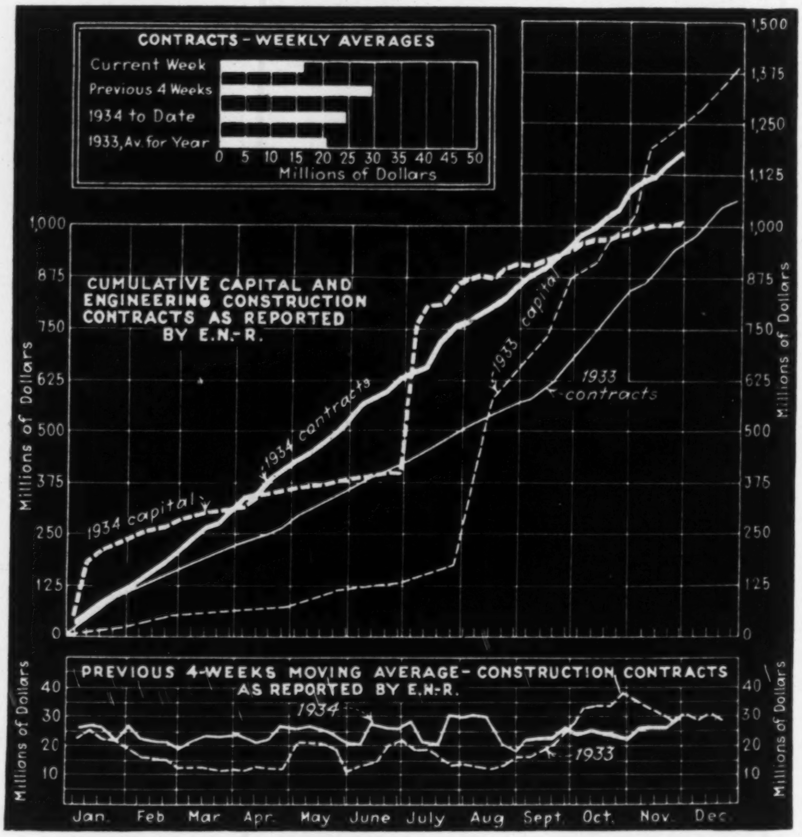
1934	Week Nov. 29	Cumulative
State and municipal....	$4,791	$301,205
PWA allotments, S&M.	....	608,397
RFC loans, S&M......	....	25,463
Corporate issues	....	18,256
PWA allotments, private	....	57,022
Total, Non-Federal..	$4,791	$1,010,343
PWA allotments, Federal Constr.	....	193,690
Total new capital....	$4,791	$1,204,033

Cumulative to date:
1933.....$1,253,994 1934.....$1,010,343

Note: These figures include private bonds, and stocks sold for productive purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, including the special highway funds; PWA private loans, and allotments for Federal construction.

INDEX NUMBER

E.N.-R.- Cost	1913 = 100	1926 = 100	E.N.-R.- Volume	1913 = 100	1926 = 100
Nov., 1934..	**201.36**	**96.76**	**Oct., 1934 .**	**98**	**43**
Oct., 1934...	200.86	96.55	Sept., 1934.	101	44
Nov., 1933...	190.14	91.40	Oct., 1933.	162	71
1933 (Av.)...	170.18	81.80	1933 (Av.)..	102	45
1932 (Av.)..	156.97	75.45	1932 (Av.)..	127	56
1931 (Av.)...	181.35	87.17	1931 (Av.)..	220	96.5



CONSTRUCTION REPORTS

WATERWORKS

PROPOSED WORK

Calif., Los Angeles—Metropolitan Water Dist., 306 West 3rd St., rejected bids Schedule 188 of Oct. 31 bid opening, for construction of 2 welded steel siphons 12 ft. 8 in. diam., 9,811 ft. long for Colorado River Aqueduct, Spec. 75. Will readvertise. Noted Oct. 25.

Calif., Pescadero—Plans water and sewerage system in Memorial Park, near here. $20,000. J. S. James, Redwood City, co. engr. It is possible that materials will be purchased by Supervs. San Mateo Co. and work performed by SERA labor.

Ga., Toccoa—Municipality plans waterworks system. $50,000. Roberts & Co., Bona Allen Bldg., Atlanta, engrs. To be financed by P.W.A. loan.

Ill., Hartford—City bids early in December improving waterworks, incl. water softening plant and appurtenances, auxiliary piping and connections. R. Horton, 650A East Big Bend Blvd., Webster Groves, Mo., engr. P.W.A. project. Noted Aug. 2.

Mass., Winchendon—Town, R. E. Smith, chn. Special Water Comn., Town Hall, preliminary survey being made extending water supply system. Fay, Spofford & Thorndyke, 44 School St., Boston, engrs.

N. Y., Buffalo—City plans constructing c.i. watermains in Parkside Section; and high pressure watermain for fire prevention in Michigan-Perry Section. $403,000. G. J. Summers, comr. P. Wks. ERB project.

O., Cardington—Village making plans waterworks system, incl. 100 ft. high steel elevated tank, 100,000 gal. capacity, and pumping station 100 g.p.m. Est. $40,000. P.W.A. project. Jennings-Lawrence Co., 12 North 3rd St., Columbus, engrs.

O., Clyde—City defeated $142,000 for filtration plant. Project indefinitely in abeyance. Geo. Champe & Associates, Nicholas Bldg., Toledo, engrs. Noted July 26.

O., Flushing—City plans waterworks system. $60,000 loan and grant approved. R. F. MacDonald, 341 Chester Twelfth Bldg., Cleveland, engr.

O., Jamestown—Bd. P. Affairs plans completed new waterworks system, incl. pumping station, elevated tank and some distribution lines. $58,000. P.W.A. project. H. Collins Wight, Union Trust Bldg., Dayton, engr. Noted Sept. 14, 1933.

O., New Concord—City plans waterworks system, $30,000 loan and grant approved. Jennings & Lawrence Co., 12 North 3rd St., Columbus, engrs.

Okla., Deer Creek—City voted $25,000, for waterworks system. P. S. Donnell, Oklahoma City, engr. P.W.A. project. Noted Dec. 21.

Okla., Helena—City voted $17,000, watermain extensions. P.W.A. project. P. S. Donnell, Oklahoma City, engr. Noted Dec. 21, 1933.

Okla., Lawton—City made plans 11,000 ft. 4 and 6 in. c.i. watermain extensions. $16,000. S. Joiner, Lawton, engr.

Okla., New Jct—City voted $20,000, waterworks system. P.W.A. project. P. S. Donnell, Oklahoma City, engr.

Okla., Stringtown—City voted $34,000, for waterworks system. P. S. Donnell, Oklahoma City, engrs. Noted Mar. 29.

Okla., Washington—City voted $14,000, to construct waterworks system. P.W.A. project. P. S. Donnell, Oklahoma City, engr. Noted Aug. 31, 1933.

Tex., Gatesville—City, c/o Secretary, indefinitely postponed bond election of $60,000 for waterworks and light plant improvements. P.W.A. project. Montgomery & Ward, Harvey-Snider Bldg., Wichita Falls, engrs. Noted Nov. 8.

Tex., Manon — City, c/o W. H. Wentland, mayor, plans waterworks system, incl. well supply, pumping station, storage tanks, reservoir and distribution system. $42,000. P.W.A. loan and grant allotted. M. C. St. John, 1406 Esperson Bldg., Houston, engr. Noted Oct. 12, 1933.

Tex., Three Rivers—City, c/o H. Coquat, mayor, rejected bids Nov. 12, waterworks improvements, incl. 2 pumping stations, elevated tank, water treatment plant and small dam. $21,000. P.W.A. project. A. A. Ririe, 655 East Woodlawn St., San Antonio, engrs. Noted Nov. 1.

Tex., Toyah—City, c/o D. F. Powell, mayor, plans waterworks, to connect with Texas & Pacific Ry. System, distribution system, fire hydrants, meters, etc. $26,000. P.W.A. loan and grant allotted. Montgomery & Ward, Harvey-Snider Bldg., Wichita Falls, engrs. Noted June 22, 1933.

Utah, Bountiful—City, preliminary plans extending waterworks system. $20,000. G. W. Harding, Bountiful, engr.

Utah, Gunnison—City voted $42,000 for replacing present wood pipe with c.i. pipe and other improvements. P.W.A. project. C. Erickson, Gunnison, engr. Noted July 26.

Ont., Belleville—C. Mott, city, engr., Belleville, soon takes bids 1,600 lin.ft. 4 in. watermains in Front St. and sewers in Station Street on at Gas works. $25,000.

BIDS ASKED

Neb., Lincoln—Dec. 5, by T. H. Berg, clk., City Hall, constructing 12th Street watermain, incl. furnishing materials. $14,500. P.W.A.

N. Y., Saratoga Springs—Dec. 14, at office Commissioner of Accounts, constructing 5 m.g. per day filter plant, coagulating basin, filters and filter house, filtered water basin, piping around plant and grading, Sect. A; filter chemical and pumping equipment, piping, valves, operating tables, controllers, chemical feed apparatus, meters, low lift and high lift and auxiliary pumping equipment, moving and erecting high lift pumping equipment, special apparatus necessary to treat and pump water. N. S. Hill, 112 East 19th St., New York, consult. engr. Noted Nov. 22.

Okla., Shawnee—Dec. 10, by T. E. Thompson, city mgr., new impounding reservoir, water supply and pipe line. $500,000. P.W.A. project. W. R. Holway, Tulsa, engr. Noted Nov. 1.

Utah, Kanah—Dec. 6, by City Council, replacing present distribution system with new steel or c.i. pipe. $40,000. P.W.A. project. J. R. Sutherland, Richfield, engr. Noted Oct. 25.

CONTRACTS AWARDED

Calif., Ventura—City Council, drilling gravel envelope type of water well on South Seward Ave., 12 in. test bore, minimum 700 ft., maximum 1,000 ft., to Roscoe Moss Co., 4360 Worth St., Los Angeles, 700 ft. well $6,526, 1,000 ft. well $8,518. Bids Nov. 13, awarded Nov. 13. A. E. Stockburger, city mgr.

Ill., Williamsville—City, waterworks and distribution system, etc., to Ostrom Realty & Constr. Co., 625 Peoples Bank Bldg., Indianapolis, Ind. Est. $47,000. **P.W.A.** Bids Nov. 8. Noted Oct. 18.

Ind., Valparaiso — City, constructing waterworks, incl. 5,820 ft. 4- to 14-in. c.i. pipe, to J. B. Clow Co., 201 North Talman St., Chicago, Ill., $22,400. Est. $25,000. Noted Nov. 1.

Mass., Townsend—Town, Bd. Water Comrs., Town Hall, furnishing, laying house service in connection with P.W.A. waterworks construction project, to C. Reppucci & Co., 10 Garden Court St., Boston, $13,915. **P.W.A.** Bids Nov. 2, awarded Nov. 19.

Mass., Townsend—Town, Bd. Water Comrs., H. B. Boynton, chn. Water Comn., Town Hall, general contract pumping station, small bridge and grading, to P. J. Heating Co., 107 Kimball St., Fitchburg, $18,689•••heating, to M. Barnicle, 33 Heywood St., Fitchburg•••granite, to D. Rusk, Townsend•••structural steel, to United Structural Steel Co., 10 Nashua St., Worcester •••reinforcing steel, to Joseph T. Ryerson & Co., Inc., 3rd St., Cambridge•••electrical work, to Alfred Senecal Co., Westboro. Bids Oct. 16.

Mass., Weymouth—Town, Bd. Water Comrs., Town Hall, excavation and structures of water filtration plant, Great Pond, to Thomas Hannaford, 64 Grove St., South Braintree, $69,888. Bids Oct. 22, awarded Nov. 20. **P.W.A.** Noted Oct. 11.

Minn., Minneapolis—City, drilling well, at City Workhouse, to McCarthy Well Co., 670 Eustic St., St. Paul, $2,470; furnishing, installing pump, to Worthington Pump & Machine Corp., 1012 Pioneer Bldg., St. Paul, $1,275. Bids Nov. 1.

Mo., Hayti—City, filter plant, basins, filters, clear well, Sect. 1, pipe work, valves, fittings, Sect. 2, 3 dry chemical feed machines, chlorinator, pumps, etc., Sect. 3, laying c.i. pipe, gate valves, etc., Sect. 4, to J. J. Miller Constr. Co., Illmo, $20,895. Est. $22,800. **P.W.A.** Bids Nov. 13.

N. M., Hatch—City Council, furnishing, installing 13,000 lin.ft. 4 and 6 in. c.i. pipe, 100 meters, dismantling, hauling and rebuilding 8,000 gal. steel tank on tower, to Hayner & Burns, Las Cruces, $27,003. **P.W.A.** Bids Oct. 27. Noted Aug. 23.

†N. Y., Forest Hills—Superintendent P. Wks., Albany, pumps and service connections for waterworks pumping station, Grand Central Parkway and Union Turnpike, to Lane Eng. Co., 118 East 28th St., New York, $30,968. Noted Aug. 23.

N. C., Murfreesboro—Mayor and Bd. Town Comrs., waterworks improvements, to Tunstall-Johnson Co., Norfolk, Va., $32,573. Est. $58,000. **P.W.A.** Noted Oct. 25.

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Commercial 219
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Federal Government projects are classified under heading denoting type of work and designated by symbol of †

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S. C., Calhoun Falls—City Council, W. J. Blake, mayor, distribution system, to J. B. McCrary Co., 1408-22 Marietta St. Bldg., Atlanta, Ga., $53,549•••tank and tower, to R. D. Cole, 57 Broad St., Newman, Ga., $5,420•••deep wells, to J. R. Connelly, Florence, $6,880. Grand total $67,257. **P.W.A.** Bids Nov. 2.

Tex., Elkhart—City, c/o J. B. Parker, mayor, complete water and sewerage systems, deep well, elevated storage tank, pipe lines, etc., to Dolph-Bateson Constr. Co., Constr. Bldg., Dallas, $29,944 (tentative award). **P.W.A.** Bids Nov. 5. Noted Oct. 25.

Tex., McKinney — City, c/o J. E. Sargent, mayor, waterworks improvements, incl. drilling deep water well, new pump house, extension to watermains, new pump equipment, wire cable guard fence, to Dodson, Humphreys & Carter, Omaha, Neb., and Tulsa, Okla., $27,931••• well, pumps and equipment, to Neil Scroggins, 3020 Myrtle St., Dallas, $22,897. Bids Oct. 23, awarded Nov. 13. **P.W.A.** Noted Oct. 11.

Tex., Stamford — City, c/o E. P. Bunkley, mayor, waterworks improvements, c.i. pipe, to J. Floyd Malcolm & Co., P. O. Box 51, Abilene, $21,313•••earthen reservoir, and treating and softening plant, to Austin Bridge Co., 1813 Clarence St., Dallas, $40,251 and $42,013 respectively•••salt water well, to G. Callahan, Albany, $8,047•••2 storage tanks, one 500,000 gal. capacity and other 1 m.g. capacity, to Pittsburgh-Des Moines Steel Co., Praetorian Bldg., Dallas, $24,575•••pumping equipment installed, to Layne-Texas Co., 6931 Hsbg., Houston, $7,919. Grand total $144,118. **P.W.A.** Bids Nov. 12.

Utah, Spanish Fork—City, excavating and installing pipe for waterworks, to E. K. Ferguson, Spanish Fork•••12,000 ft. 8 and 12 in. c.i. pipe, to Pacific States Cast Iron Pipe Co., Provo•••15,000 ft. 15 in. c.i. pipe, to U. S. Pipe & Fdry. Co., Webb Crawford Bldg., Birmingham, Ala.•••valves and valve boxes, to A. P. Smith & Co., Los Angeles, Calif.•••calco gate valves, to R. Hardesty Co., 631 South 3rd St., Salt Lake City•••manholes and screens, to Waterworks Equipment Co., 149 West 2nd St. S., Salt Lake City. Est $88,000. **P.W.A.** Bids Nov. 7. Noted Aug. 23.

Vt., Vergennes—City, City Clerk, City Hall, constructing gravity water supply system, consisting of 35,000 lin.ft. 10 in. and 600 lin.ft. 6 in. c.i. pipe lines, 2 earthen dams and spillways, meters and chlorination house, 500,000 gal. steel standpipe and appurtenances, to W. G. Fritz Co., 69 Main St., West Orange, N. J., $145,497. **P.W.A.** Bids Sept. 28, awarded Nov. 19. Noted Sept. 20.

Tex., Del Rio—City, J. Long, mayor, waterworks improvements, distributing lines, large main, steel pipe, purifying plant, large pumping plant, 2 or 3 electrically driven 150 hp. motors, fire plugs, meters, 19,000 ft. 6- to 8-in. pipe and 43,000 ft. 2 in. vitr. pipe, to Ulen Contg. Co., San Antonio, $67,978. Est. $80,000 (tentative award). **P.W.A.** Noted Nov. 1.

Wis., Hilbert—City, to J. B. Clow & Sons, 201 North Talman St., Chicago, Ill., 3,100 lin. ft. 6 in. pipe 73.75c. per lin.ft.; 2,400 lin.ft. 8 in. at $1.06 per ft.•••to Brillion Iron Wks., Brillion, 4 tons fittings, $108•••to Milwaukee Lead Co., 3139 North 31st St., Milwaukee, 150 lb. jute at 9c. per lb.; 2 tons lead, 45c. per lb.•••to Darling Valve & Hydrant Co., Williamsport, Pa., three 6 in. valves, $20.16 each; five 8 in. valves, $31.68 each•••to Iowa Valve Co., 701 Hubbell Bldg., Des Moines, Ia., 8 manhole covers at $3 each. A. E. McMahon, Menasha, engr.

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SEWERAGE AND WASTE DISPOSAL

PROPOSED WORK

California—Cities of Seal Beach and Sunset Beach plan joint sewerage system and disposal plant. P.W.A. allotted $96,000 of which 30% is grant. V. Hayes, Seal Beach, engr. Noted Apr. 19.

Calif., Pescadero—See "Waterworks."

D. C., Wash.—District Commissioner, District Bldg., retained Metcalf & Eddy, engrs., 1300 Statler St., Boston, Mass., to prepare detailed designs and specifications of sewage disposal plant. $4,000,000. P.W.A. project.

Ind., Princeton—City, O. T. Brazelton, mayor, soon takes bids sewage treatment plant, 3,400 ft. intercepting sewers, mechanical clarifiers, trickling filters, gas collection and burning equipment, sludge digestion tanks, 150 ft. deep well, horizontal screw fed centrifugal pump, hot water radiators, circulating pump, water heater, digester tank, c.i. pipe, asbestos roofing, pre-cast concrete pipe, venturi meters, and laboratory equipment, etc. $110,000. P.W.A. project. Babcock & Finch, 276 Century Bldg., Indianapolis, engrs. Noted July 12.

†Md., Annapolis—Yards & Docks, Navy Dpt., Wash., D. C., rejected bids additions and alterations to sewerage system. Spec. 7517.

Mass., Adams — Town, Bd. Selectmen, H. Blanchette, clk., Town Hall, preliminary plans sanitary sewerage system and sewage disposal plant. Special committee will report on project at Town Meeting in March 1935. To exceed $25,000. H. C. Neff, town engr. S. M. Ellsworth, 12 Pearl St., Boston, engr. Noted Mar. 29.

Mich., East Tawas—Municipality, plans sewage disposal plant. Burridge & Dillman, Lansing, engrs. $30,000.

Minn., St. Cloud—City plans garbage incinerator on west side Mississippi River, below dam. Excavation begun. Relief labor project. $30,000. R. Borrowman, city engr. L. C. Pinault, Granite Exch. Bldg., archt.

Neb., Omaha—City Comrs. will act in 2 weeks on resolution introduced for constructing Burt-Ixard Sewer Project, incl. 3 mi. sanitary sewer on Burt St., from 39th St. to Missouri River. $500,000-$1,000,000. P.W.A. project. W. J. Provaznik, sewer engr. Noted Oct. 12, 1933.

N. J., New Providence—Municipality indefinitely postponed constructing sewage disposal plant. $25,000. Clyde Potts, 30 Church St., New York, engr. Noted Oct. 12, 1933.

N. D., Lisbon—Voted $40,000 bonds, constructing sewage disposal plant. Engineer not appointed. W. R. Sandager, city aud. Noted Nov. 1.

O., Cleveland—City, W. J. Rogers, dir. P. Utilities, plans by G. B. Gascoigne, engr. and archt., Leader Bldg., 1 story, 75x250 ft., brick, steel, rein.-con. blower building for Easterly sewage treatment plant, concrete pile found., East 140th St. and Lake Ave. P.W.A. project. $300,000. Noted Jan. 11.

O., Columbus—W. J. Lucks, dir. Serv., preparing plans constructing Sect. 10 Olentangy-Scioto Intercepting Sewer, across Olentangy Park, involving 900 ft. tunnel, 3,700 ft. 42- to 60 in. rein.-con. pipe. Est. about $180,000. P.W.A. project. P. W. Maetzel, City Hall, engr.

O., East Palestine—City, W. A. Shasteen, mayor, preparing sketches sewage disposal plant. Est. about $35,000. May petition for P.W.A. help. H. T. Barckhoff, City Hall, city engr. Noted Oct. 4.

Okla., Blanchard—City made preliminary plans sanitary sewerage system. $35,000. R. E. Whiteneck, Bass Bldg., Oklahoma City, engr.

Ont., Belleville—See "Waterworks."

BIDS ASKED

Calif., Half Moon Bay—Dec. 7, by Trustees of Half Moon Bay Sanitary Dist., sanitary sewerage system. To exceed $25,000. G. A. Kneese, Redwood City, engr. Noted Nov. 22. Former bids rejected.

Calif., Oxnard—Dec. 11, by City Council, sludge digestion type or Imhoff tank type treatment plant. $72,000. P.W.A. project. Currie Eng. Co., San Bernardino, engr. Noted Nov. 22.

Ill., Abington—Dec. 15, by City Council, City Hall, sewage disposal plant, trickling filter type, $47,000. P.W.A. project. Wells Eng. Co., Court House, Geneva, engrs. Noted July 19.

Ill., Batavia—Dec. 13, by City, J. Van Burton, mayor, sewage treatment plant. $100,000. P.W.A. project. Wells Eng. Co., Court House, Geneva, engrs.

Minn., Minneapolis—See "Contracts Awarded."

Mo., St. Louis—See "Bridges and Grade Crossings.

N. Y., Brooklyn—Dec. 3, by R. V. Ingersoll, pres. Brooklyn Boro, Boro Hall, storm water and sanitary sewers in Avenue Z, Sheepshead Bay Rd., East 14th, East 13th, East 12th Sts.

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O., Columbus—Dec. 6, by W. J. Lucks, dir. Service, constructing West Side Alum Creek Sewer from Clifton to Ridgeway Aves., Contr. 7, Sect. 3, involving 4,050 ft. 42 in. and 2,080 ft. 36 in. rein.-con. pipe, 17,500 cu.yd. excav. 8,500 cu.yd. concrete, 1,100 cu.yd. concrete cradle, about 12 ft. deep. $85,900. P.W.A. project. P. W. Maetzel, City Hall, engr.

Pa., Ambler—Dec. 3, by D. Cavalier, secy of Council, materials for sewage disposal plant incl. sewage pumps and motors, sludge pumps and motors, aerators for activated sludge mechanical sludge collectors, glass enclosure for sludge beds and c.i. wall castings. Work by L.W.D. labor. Allbright & Friel, 246 South 15th St., Phila., engrs. Noted Oct. 26.

Tex., Louisville—Dec. 7, by City, c/o A. Hayes, mayor, complete sewerage system and sewage disposal plant. $31,000. P.W.A. project. F. J. Von Zuben, 807 Fair Bldg., Fort Worth, engr.

Wis., Kendall—Dec. 4, by R. Jirschele, village clk., sewage disposal plant, incl. piping fitting, valves, 2 non-clog sewage and sludge pumps, clarifier equipment, circulator distributors for filter, Contr. 1; excavating, grading, and materials for sewage plant and installing equipment, Contr. 2. P.W.A. project. W. G. Kirchoffer, Madison, engr. Noted Apr. 5.

CONTRACTS AWARDED

Ark., Carlisle—E. D. Buechley, recdr., Incorporated town of Carlisle, complete sanitary sewerage system, to Hill & Evans, 115 North Spring St., Little Rock, $21,903 (tentative award). Est. $33,000. **P.W.A.**

Ark., Cotton Plant—City, complete sewerage system, to McEachin & McEachin, Inc., Rector Bldg., Little Rock, $36,953. Est. $41,000. Bids Nov. 14, awarded Nov. 14. **P.W.A.** F. L. Maxwell, Cotton Plant, recdr.

Calif., Los Angeles—Bd. P. Wks., constructing decanters, pumping plant found., Venturi flume, drainage sump and roadway at Terminal Island Sewage Pumping Plant, to L. W. O'Dell, 6417 Drexell Ave., $18,994, subject to P.W.A. approval. Bids Nov. 7, awarded Nov. 16. **P.W.A.**

Calif., Los Angeles—City, Bd. P. Wks., rein.-con. pump pit, Harbor Blvd., Sewage Pumping Plant, to Fred F. Greenfield Co., 7310 South Figueroa St., $12,884, subject to P.W.A. approval. Bids Oct. 24, awarded Nov. 16. **P.W.A.**

†D. C., Wash.—Dpt. Agriculture, Wash., D. C., constructing sewage treatment works, to Industrial Fireproofing Corp., 41 East 42nd St., New York, N. Y., $67,463.

Ill., Breese—City, 50,720 lin.ft. 8- to 18-in. vitr. clay pipe, 20,000 ft. lumber, 142 manholes, 150 ft. 8 in. drop pipe, 50 cu.yd. concrete, brick service building, two 100 g.p.m. centrifugal sewage pumps, primary clarifier, 2 aeration tanks, 1 secondary clarifier, one sludge digestion tank, to Hartman & Clark Bros. Constr. Co., Peoria, $84,991. Est. $95,800. **P.W.A.** Bids Nov. 8. Noted Nov. 1.

Md., Cumberland—City, G. W. Leggs, mayor, interceptor sewer, Contr. 2, to Seaboard Contractors, Inc., and Richard Kelly Co., Real Estate Trust Bldg., Phila., Pa., $165,883. Bids Oct. 25. **P.W.A.**

Mass., Boston—City, Dpt. P. Wks., C. J. Carven, comr, City Hall Annex, concrete pipe sewerage work, in Laurel and Ottawa Sts., at Naywoods Brook, to Jas. J. Coughlan & Sons, Inc., 80 Federal St., $30,643. Bids Nov. 1, awarded Nov. 16.

Mich., Charlevoix—R. S. Hamilton, city clk., constructing Div. A, 4,600 ft. 8- to 21-in. sewers, Sect. B, settling tanks, sludge drying beds, building housing settling tanks, sludge pumping station and appurtenances, and Div. E, river crossing, 8 in. c.i. pipe at sewage disposal works, to H. G. Christman Lansing Co., Lansing, $61,691. **P.W.A.** Bids Oct. 8.

Mich., Charlotte—L. B. Frace, city clk., rein.-con. sewage treatment plant, incl. sedimentation tank, sludge digester, covered sludge bed, control house and sewer connections, to Owen-Ames-Kimball Co., Grand Rapids, $23,853. **P.W.A.** Bids Nov. 5.

Minn., Minneapolis — City, constructing interceptor sewers, Contr. 303, Div. A and Contr. 304, Div. B, by day labor, under supervision of city engineer, $131,305 and $142,190 respectively. Bids Nov. 5 rejected. **P.W.A.**

N. Y., Long Island City—J. J. Halleran, acting pres. Queens Boro, Queens Subway Bldg., storm sewer in Woodhull St., to Pan Constr. Co., 244 Jackson Ave., $72,965. Bids Oct. 23. Noted Oct. 18.

O., Bowling Green—Director Service, Unit 2, relief sewers, to McKechnie-Pierce Co., 112 East Woodruff Ave., Toledo, $103,214; Contr. 1, deepening ditch, etc., 83,500 cu.yd. excav., to Lander & Son, Inc., Box 52, Station E, Toledo, $24,149. **P.W.A.** Bids Aug. 16. Noted Aug. 9.

O., Springfield—P. A. Lewis, city engr., furnishing (only) 8,628 ft. 30- to 42-in. rein.-con. sewer pipe, Contr. 12, Sects. H, I and J, to Price Bros., Dayton, $28,574. **P.W.A.** Bids Nov. 8.

Wis., Fenimore—City, constructing sewerage system, to Bohr Constr. Co., Manitowoc, $49,864***disposal plant and relief station, to

†Federal Government.

Sewerage, etc. (Continued)

Pecholski & Doligolski, 607 West Mitchell St., Milwaukee, $29,796***rotary distributor, to American Well Wks., Aurora, Ill., $2,036*** digestor equipment, to Dor Co., 221 North LaSalle St., Chicago, Ill., $1,386***sludge pumps, to Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill., $575***pumping equipment, to Yeomans Bros., 1433 Dayton St., Chicago, Ill., $1,807. Grand total $85,464. **P.W.A.** Bids Sept. 28. Noted Oct. 11.

BRIDGES AND GRADE CROSSINGS

PROPOSED WORK

Calif., Berkeley—State Dpt. P. Wks., C. H. Purcell, ch. engr., P. Wks. Bldg., Sacramento, granted permission by State Railroad Comn. to construct crossing at separated grades on North East Bay approach to San Francisco-Oakland Bay Bridge and the tracks of the Southern Pacific R. R. Co. at point midway between westerly ends of Folger Ave. and Murray St. To exceed $25,000.

Calif., Burlingame—City making surveys 1,080 ft. viaduct 50 ft. wide at Broadway intersection with Southern Pacific R. R. tracks to separate railroad and hy. grades. $100,000 or more. C. M. Thomas, city engr.

Colo., Pueblo—State Hy. Dpt., Denver, C. D. Vail, engr., J. D. Bell, div. engr., plans double underpass under Missouri Pacific and Santa Fe R.R. tracks at Belle Plain, 3 mi. east of Pueblo on Kansas-Colorado Blvd. $68,000. Part P.W.A. funds.

Mass., Springfield—City, Bd. P. Wks., making plans constructing underpass at Crosstown Blvd. and State St. To exceed $25,000. C. W. Phillips, engr.

N. Y., Bethany—Delaware, Lackawanna & Western R.R. Co., M. H. Doughty, ch. engr., Hoboken, N. J., soon takes bids general contract eliminating grade crossing on Pavilion Batavia Hy., here, $112,700. Changes in telephone and telegraph lines awarded to Western Union Telegraph Co., 60 Hudson St., New York. Public Service Comn. granted permission for work to be done by day labor to extent of $7,550. Noted Nov. 6, 1930.

Oregon—State Hy. Comn., Salem, plans eliminating 47 grade crossings. $5,000,000. Program submitted to Federal Public Wks. Administration.

Texas—State Hy. Comn., J. Wood, chn., Austin, plans constructing Wichita River, Groton Creek, Little Groton Creek and Beef Hollow Creek Bridges, Hy. 24, S.P. 823-G and H. Dickens Co.; bridge over Salt Fork of Brazos River, Hys. 23 and 30, Seymour, Baylor Co., all steel and concrete.

Tex., Port Arthur—City, J. W. Williams, mgr., plans 780 ft. rein.-con. steel vehicular and pedestrian bridge, 176 vert constr. over Neches River. $1,500,000. Plans now in hands of State Legislature for approval. Expect to be in position to take bids soon. A. P. Rollins, Port Arthur, engr.

Wash., Tenino — State Hy. Dpt., Olympia, plans lowering existing viaduct and changing pavement for 2,000 ft. approaching the viaduct, $35,000-$45,000. P.W.A. project.

BIDS ASKED

Arizona—Dec. 6, by State Hy. Comn., Phoenix, widening concrete bridge on Globe-Miami Hy., in Miami, incl. 60 cu.yd. structural excav. T. S. O'Connell, state hy. engr.

California—Dec. 12, by State Hy. Comn., Sacramento, steel beam, concrete bridge on concrete piers and abutments, over Kings River and grading, bituminous treating, crushed gravel or stone surfacing 1.2 mi. roadway approaches, Fresno Co.; bridge over North Fork Feather River at Tobin, Plumas Co. C. H. Purcell, Public Wks. Bldg., Sacramento, engr. for this letting withdrawn.

Iowa—Dec. 4, by State Hy. Comn., Ames, constructing 4 corrugated metal pipe, 5 rein.-con. pipe, 2 rein.-con. box and 1 rein.-con. arch culverts on Secondary Road between Unionville and northeast corner of county, NRS-511, Appanoose Co.; I-beam bridges on Primary Rd. 73, north of Larrabee, NRH 247-D, Cherokee Co.; 3 I-beam span bridge and 1 rein.-con. box culvert on Secondary Rd. 275, NRS 513-AB, Fremont Co.***1 bridge on Secondary Rd., southeast of Albia NRS 510, Monroe Co.; one skew continuous I-beam and 2 I-beam bridges on Primary Rd. 33, between Sheldon and Ashton, NRH-498, DE, O'Brien and Osceola Counties. F. R. Parsons, ch. engr.

Ia., Ottumwa—Dec. 18, by State Hy. Comn., Ames, constructing viaduct over Des Moines River, Chicago, Burlington and Quincy R.R., Chicago, Rock Island & Pacific R.R., and Chicago, Milwaukee, St. Paul & Pacific on extensions of Roads 34 and 63, alternate designs 134 and 134A. H. O. Parsons, ch. engr.

Mo., St. Louis—Dec. 18, by Bd. P. Service, City Hall, constructing 22 ft. rein.-con. culvert, 56 ft. long, and 36 in. foul water sewer, etc., for channel of River Des Peres Parkway between Lansdowne and Loughborough Aves. $18,000. L. A. Pettus, city engr.

New Jersey—Dec. 10, by State Hy. Comn., Trenton, constructing bridge carrying Route 10, Sect. 5, across ramp to Morris Turnpike, near Succasunna, Morris Co., incl. 1,170 cu.yd. foundation excav. A. L. Grover, ch. clk.

N. Y., New York—Dec. 3, by F. J. H. Kracke, comr. Plant & Structures, Municipal Bldg., removing old pile cluster and constructing new pile cluster at easterly end of center pier fender of Willis Ave. bridge over Harlem River, removing old pile cluster, and reconstructing part of fender rack on north side West Pier Eastchester Creek, both Bronx Boro.

N. Y., Jamestown—See "Contracts Awarded."

Pa., Pittsburgh—Dec. 4, by R. G. Woodside, comr. Allegheny Co., reinforcing floor system, sidewalks, brackets, and truss members main span and north approach Glenwood Bridge 8; protective railing Liberty Bridge 10; structural repairs to trusses and floor system, Browns Bridge 4, all foregoing over Monongahela River; structural repairing to stiffening trusses and towers, 3rd Ave. bridge, McKeesport 2, Youghiogheny River. E. L. Schmidt, 416 Co. of Bldg., engr.

Wisconsin—Dec. 7, by State Hy. and St. Croix Co., Hy. Comn., Madison, constructing North Rush River Bridge, State Trunk Hy. 46, State Project 6305, St. Croix Co., incl. 465 cu.yd. excav.

Wis., Jefferson—Municipality bids about Feb. 1, constructing Racine Street Bridge, incl. 250 tons steel. To exceed $25,000.

CONTRACTS AWARDED

Colorado—State Hy. Dpt., Denver, Colo., 3 span continuous rein.-con. bridge, across Cherry Creek, on Colorado Blvd., Denver and Arapahoe Counties, to Thomas Bate, 2311 10th Ave., Denver, $25,197. Bids Nov. 15, awarded Nov. 19.

Idaho, Weiser—State Hy. Comn., Boise, 312 ft. concrete bridge over Weiser River, to C. F. Dinsmore Co., Ogden, Utah, $42,160.

Iowa—State Hy. Comn., Ames, creosoted wood box culvert in Monona Co., to V. L. Lundeen, Montezuma, $695. Bids Nov. 20. Noted Nov. 15.

Mass., Norwood — P. J. Feeney, chn. Bd. Selectmen, Town, and Commonwealth of Massachusetts, at office P. Wks. Dpt., 100 Nashua St., Boston, rigid frame rein.-con. railroad bridge with stone facing of about 67 ft. span under New York, New Haven & Hartford R.R., 500 ft. grading approaches, Nahatan St. Ext., to Simpson Bros. Corp., 193 Hanover St., Boston, $57,843.

Nebraska—Dpt. Roads & Irrigation, Lincoln, to Diamond Eng. Co., Grand Island, culverts in Custer Co., $6,329; bridges in same county, $7,864; culverts in Hall Co., $3,873***to Artificial Stone Co., Bruning, culverts in Fillmore Co., $3,293; bridge in same county, $6,675; culverts in Boone Co., $6,210; culverts in Boone Co., $999***to Central Bridge & Constr. Co., Wahoo, culverts in Washington Co., $13,504; bridge Thurston Co., $2,750; culverts same county, $6,956***to Beaty Contg. Co., Blair, bridge in Washington Co., $6,251***to Bushman Constr. Co., St. Joseph, bridge in Red Willow Co., $62,224***to G. E. Smith, 525 South 13th St., Lincoln, culverts in Nehama Co., $6,918, culverts in Pawnee Co., $13,077*** to G. W. Condon Co., 219 Grain Exch. Bldg., Omaha, bridge in Franklin Co., $16,262; in Pawnee Co., $11,326; in Nemaha Co., $10,197; in Sheridan Co., $19,871. Grand total $201,196. Bids Nov. 16.

New York—A. W. Brandt, comr. Hys., Albany, bridges in Otsego Co., to J. A. Spooner, Albany, $26,290 est. $31,523***Essex Co., to Millers Bros. Constr. Co., 410 Asylum St., Hartford, Conn., $273,542 est. $311,404***grade separation, Westchester Co., to A. E. Ottaviano, Inc., Croton-on-Hudson, $212,275 set. $291,414 ***Washington Co., to Pallette & Santos, Amsterdam, $148,334 est. $184,737. Grand total $660,441. **P.W.A.** Bids Oct. 30 and Nov. 13.

N. Y., Bethany—See "Proposed Work."

N. Y., Jamestown—Erie R.R. Co., G. S. Fanning, ch. engr., Midland Bldg., Cleveland, O., eliminating grade crossing at Fairmount Ave., by day labor. $22,600. Public Service Commission directed above work to be done. Noted Oct. 18.

N. Y., Windsor—Delaware & Hudson R.R. Co., J. MacMartin, ch. engr., Albany, eliminating grade crossing on Windsor-Deposit State Hy., to Foley Bros., Inc., 135 East 42nd St., $119,037.

Pennsylvania—See "Streets and Roads."

Texas — State Hy. Comn., J. Wood, chn., Austin, constructing Lampasas River Bridge, consisting of four 40 ft. I-beam spans, 1 unit of two 108 anchor and one 63 ft. 10 in. suspended deck plate girder span, on Hy. 2, NRH 644-A, Bell Co., to C. W. Gilfillan, Norwood Bldg., Austin, $46,894. Est. $40,000. **P.W.A.** Bids Nov. 8.

Tex., Dallas—State Hy. Comm. J. Wood, chr., Austin, furnishing materials for revision of Union Terminal R.R. facilities in connection with Main, Elm and Commerce Sts. underpass extension project, to Austin Bridge Co., 1815 Clarence St., $144,920. **P.W.A.** Noted Aug. 23.

Vermont—State Hy. Dpt., Montpelier, 40 ft. single span rein.-con. T-beam bridge and gravel approaches on Route 15, NRH 84-C-11, Wolcott, to H. P. Cummings Constr. Co., 14 Prospect St., Ware, Mass., $4,937, bids Oct. 26; 2 span

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Bridges, etc. (Continued)

steel I-beam bridge with gravel approaches on Route 103, NRM 99B, Chester, to O. A. Priest, Belmont, $17,399. Bids Nov. 2. **P.W.A.**

Virginia—State Hy. Dpt., Richmond, overhead bridge in Montgomery Co., to R. W. Moore & Co., Staunton, $22,579; bridge in Smyth Co., to E. P. Ellis, Marion, $5,673. Bids Nov. 15.

West Virginia—State Road Comn., Charleston, bridge in Fayette and Kanawha Counties, to E. R. Mills, Charleston, $28,610***Pendleton Co., to Solazo Constr. Co., Riverton, $10,404***superstructure of same bridge, to Midland Structural Steel Co., Cicero, Ill., $12,271. Grand total $51,285. Bids Nov. 20. Noted Nov. 15.

†Wyoming — Pub. Rds., Denver, Colo., 2 bridges and approaches in Yellowstone Natl. Park, to C. M. Smith, Thermopolis, $22,387. Bids Oct. 31. Noted Oct. 23 Daily.

STREETS AND ROADS

BIDS ASKED

†California—Apr. 4, by C. H. Sweetser, dist. engr. Pub. Rds., 461 Market St., San Francisco, bituminous surface treating 12.45 mi. Sect. C, Route 77-Mount Shasta-Mount Lassen Natl. Forest Hy., Siskiyou Co.

†California—Apr. 5, by C. H. Sweetser, dist. engr., Pub. Rds., 461 Market St., San Francisco, bituminous surface treating Sect. A, Route 11, Lava Beds Natl. Forest Hy., Modoc Co.

D. C., Wash.—Dec. 3, by Dist. Comrs., District Bldg., paving Virginia Ave. N.W., between Constitution Ave. and 26th St.

D. C., Wash.—Dec. 4, by District Comrs., District Bldg., paving 18th and Columbia Rd. and Florida Ave.

Ill., East St. Louis — City bids early in 1935, concrete or asphalt paving 9 blocks 3rd St., between Missouri and St. Clair Aves. $85,000. State Hy. Dpt. is expected to share cost. W. McK. Brown, city engr.

Iowa—Dec. 4, by State Hy. Comn., Ames, grading 6.773 mi. Secondary Rd. between Unionville and northeast corner county NRS 551-AB, Appanoose Co., incl. 159,817 cu.yd. excav. F. R. White, ch. engr.

Ia., Iowa City—Dec. 5, by Johnson Co., constructing 9.022 mi., and 9.598 mi., and 4.418 mi. secondary roads. R. H. Justen, co. engr.

Maine—See "Contracts Awarded."

Massachusetts—Dec. 4, by Commonwealth of Massachusetts, F. E. Lyman, comr., 100 Nashua St., Boston, bituminous macadam paving 31,547 ft. and bituminous concrete paving 5,115 ft. Projects NRH 250 and NRM 91, Dracut, Methuen and Lowell. To exceed $200,000.

Mass., Boston—Dec. 3, by City, C. J. Carven, comr., Dpt. P. Wks., City Hall Annex, sheet asphalt or bitulithic paving Hyde Park Ave. from Walk Hill St. to Cummins Hy., Roslindale. To exceed $45,000. P.W.A. project.

Mass., Boston—Dec. 4, by City, Dpt. P. Wks., C. J. Carven, comr., City Hall Annex, sheet asphalt or bitulithic paving La Grange St. from Washington to Centre Sts., Ward 20, Sect. "B". To exceed $35,000. P.W.A. project.

New Jersey—Dec. 10, by State Hy. Comn., Trenton, grading, rein.-con. paving 20,836 sq.yd. Route 35, Sect. 3B and 9, Shark River bridge approaches and River Ave. widening, Belmar Boro, Monmouth Co., incl. 4,268 cu.yd. unclassified excav. P.W.A. project.

N. Y., Brooklyn—Dec. 5, by R. V. Ingersoll, pres. Brooklyn Boro, Boro Hall, asphalt surfacing by heater method, Taaffee Pl., Putnam Ave., Beadel, Harmon, North 8th, Weirfield and Jackson Sts.; grading, granite block surfacing Meeker Dr.; asphalt on concrete paving 16th, 48th and 67th Sts.

N. Y., Long Island City—Dec. 3, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., cold laid asphaltic concrete on prepared macadam repaving Dry Harbor Rd. and Maurice St.; sheet asphalt on concrete repaving Northern Blvd. and Cypress Hills St.

N. Y., Waterloo—See "Contracts Awarded."

Ohio—O. W. Merrell, dir. Hys., Columbus, cancelled bids to have been opened Nov. 16, removing old car tracks and portions of existing pavement, building up base, resetting present drainage castings, hot mixed asphaltic concrete paving 2.308 mi. Sect. "Delaware" (Sandusky St.) Columbus-Sandusky Rd., Delaware Co., $67,572.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, rejected bids Nov. 2, rein.-con. paving 4,600 ft. R-170, Sect. 9, Ashley Borough, Hanover Twp., Luzerne Co. P.W.A. project. Noted Oct. 25.

Pennsylvania—Dec. 7, at office S. S. Lewis, secy. Hys., Harrisburg, rein.-con. paving 4,600 ft. R-170, Sect. 9, Ashley Borough, Hanover Twp., Luzerne Co., involving 40,816 cu.yd. Class 1, 588 cu.yd. Class 2 and 2,000 cu.yd. borrow excav.; rein.-con. paving, consisting of widening existing pavement for width of 11 ft. on each side and new pavement for 40 and 50 ft. width, on 6,227 ft. R-157, Sect. 8, Allentown, Lehigh Co., 9,206 cu.yd. Class 1 and 1,653 cu.yd. Class 2 excav.; rein.-con. paving, native stone or modified broken stone base course paving 6,452 ft. R-186, Sect. 4, Jefferson Twp., Somerset Co., involving 28,293 cu.yd. Class 1 and 568 cu.yd. Class 2 excav.; foreign borrow surfacing, bituminous surface course Spec. E on stone base, rein.-con. bridge 1,101 ft. R-397, Sect. 2, South Fayette and Collier Twps., Allegheny Co., 3,012 cu.yd. Class 1 and 305 cu.yd. Class 2 excav.; bituminous surface P.M. 2 on native stone or modified broken stone paving 18 ft. and grading road approach 17,525 ft. R-445, Sect. 1, Independence, Hanover and Raccoon Twps., Beaver Co., 33,555 cu.yd. Class 1, 1,690 cu.yd. Class 2 and 1,303 cu.yd. borrow excav.; native stone or modified broken stone base course paving 22,132 ft. R-115, Spur, Frankfort Springs Borough, Hanover Twp., Beaver and Washington Counties, 60,663 cu.yd. Class 1, 2,434 cu.yd. Class 2 and 443 cu.yd. borrow excav.; bituminous surface course Spec. E on existing brick paving 4,290 ft. R-25-20, Erie, Erie Co., bituminous surface course Spec. E on native stone base paving, grading approach 9,646 ft. R-951, Sect. 1, Jefferson Twp., Lackawanna Co., 7,649 cu.yd. Class 1, 343 cu.yd. Class 2 and 2,024 cu.yd. borrow excav.; rein.-con. paving 3,458 ft. R-275, Howe Twp., Perry Co., 20,850 cu.yd. Class 1 and 135 cu.yd. Class 2 excav.; dual type, two 10 ft. outside lanes of rein.-con. and 10 ft. center lane of bituminous surface Spec. E on native stone base paving, etc., 7,027 ft. R-8, Sect. 3, Westfall Twp., Pike Co., 22,267 cu.yd. Class 1, 750 cu.yd. Class 2 and 1,148 cu.yd. borrow excav.; rein.-con. widening existing pavement, rein.-con. culvert, 7,530 ft. R-157, Sect. 10, South Whitehall Twp., Lehigh Co., 13,446 cu.yd. Class 1 and 803 cu.yd. Class 2 excav.

Wash., Seattle—City Council soon takes bids paving and sewers in Beacon Ave. extension, $73,100. T. W. Beeman, engr.

Wisconsin—Dec. 7, by State Hy. and Outagamie and St. Croix Counties Hy. Comns., Madison, concrete surfacing 0.796 mi. Baraboo-Portage Rd., 8th Ave.-City of Baraboo, Sauk Co., incl. 5,780 cu.yd. earth excav.; 7.6 mi. Bosobel-Fennimore-Dubuque Rd., Dickeyville-Lancaster Sect., Hy. 61, NRH 376-C and NRH 208, Grant Co., 234,324 cu.yd. borrow, ditches, channel excav., 18,600 cu.yd. loose rock and 58,096 cu.yd. solid rock excav.; 0.328 mi. River Street-Village Shiocton Rd., State Hy. 54, S. Project 3573, Outagamie Co., 1,843 cu.yd. earth and 77 cu.yd. solid rock excav.

CONTRACTS AWARDED

†Arizona — Pub. Rds., Phoenix, grading, draining, placing subgrade reinforcement 7.563 mi. road in Coconino Co., to Tiffany Constr. Co., San Jose, Calif., $76,892. Bids Oct. 25.

California—State Hy. Comn., Sacramento, grading, crushed run base and bituminous surface treating 2.7 mi. hy. between point 3 mi. east of Half Moon Bay and Summit, San Mateo Co., to Mittry Bros. Constr. Co., 5531 Downey Rd., Los Angeles, $149,865. Bids Nov. 14. Noted Nov. 1.

Colorado—State Hy. Dpt., Denver, graveling 6.422 mi. road in Weld Co., to M. E. Carlson, 4483 Newton St., Denver, $81,562***graveling 0.0625 mi. Mineral Co., to Mackey & DeRemer, 1750 Bryden St., Denver, $30,958***2.253 mi. Teller Co., to W. A. Colt & Son, Lyons, $29,912. Grand total $142,432. Bids Nov. 8, awarded Nov. 16.

Connecticut—State Hy. Dpt., State Office Bldg., Hartford, bituminous macadam on broken stone paving 23,846 ft. Route 202, NRS 70, Killingly, to A. I. Savin Constr. Co., $202,618. **P.W.A.** Bids Nov. 5, awarded Nov. 13.

Ind., Connersville—City, asphalt resurfacing city streets, to W. L. Magaw, Richmond, $26,437.

Iowa—State Hy. Comn., Ames, maintenance gravel resurfacing in Cherokee Co., to Harvey Sand & Gravel Co., Harvey, $2,120; in Monona Co., to C. R. Gates, Ottumwa, $25,206. **P.W.A.** Bids Nov. 20. Rejected bids concrete paving 0.024 mi. Hancock Co. Noted Nov. 15.

Kansas—State Hy. Comn., at office of County Clerk, Dodge City, (**P. means Project**), to Yancey Constr. Co., Abilene, earthwork and culverts 5.114 mi. P. NRS 489-A, $33,963; three 14x14x32 ft. rein.-con. bridge P. NRS 489-A, $5,018; two 10x10x63 ft. rein.-con. bridge, P. NRS 489-A, $3,730 two 12x12x49 ft. rein.-con. bridge, P. NRS 489-A, $3,771***to Cook Gardens, Ottawa, roadside improvement 5.114 mi. NRS 489-A, $556; 0.128 mi. P. 283-5-NRM 233-E, $110, all foregoing in Ford Co.*** to Geiger & Rutherford, Leavenworth, concrete paving, roadside improvement 0.331 mi. P. 50-N-6A, NRM 359-E, Finney Co., $23,833***to Stamley & Tidd, Hutchinson, concrete paving 0.128 mi. P. 283-5 NRM 233-E, Ford Co., $11,939. Grand total $82,920. **P.W.A.** Bids Nov. 8. Noted Oct. 25.

Kansas—State Hy. Comn., at office of County Clerk, Kingman, (**P. means Project**), to Koss Constr. Co., 205 Old Colony Bldg., Des Moines, Ia., concrete paving 8.87 mi. P. 54-2-PWS 13 (Docket 4764) Kingman Co., $207,725***to A. L. Cook, Ottawa, roadside improvement 8.87 mi. P. 54-20-PWS 13, Docket 4764, Kingman Co., $840***to Cook Gardens, Ottawa, 5.064 mi. P. 8-6A NRH 508-A, Pratt Co., $148; 0.275 mi. P. 8-6B-NRM 508-B Pratt Co., $322*** to Stamey & Tidd, Hutchinson, earthwork and culverts, 5.064 mi. P. 8-6A-NRH 508-A, $15,245; three 8x7x32 ft. rein.-con. bridge P. 8-6A-NRH 508-A, $2,056; 0.275 mi. P. 8-6B NRM 508-B, $3,376***to J. S. Vance & Son, Parsons, eight 30 ft. rein.-con. deck girders, P. 8-6B, NRM 508-B, $16,051, all foregoing in Pratt Co. **Grand total $245,763. P.W.A. Bids Nov. 9.**

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†Federal Government.

Streets and Roads (Continued)

Kentucky—State Hy. Comn., Frankfort, traffic bound limestone paving 4.671 mi. Hardinsburg-McQuady Rd., S.P. 45-AS, Breckinridge Co., to H. L. Johnson & Co., Lewisport, $16,423; 11.494 mi. Madisonville-Princeton Rd., S.P. 417-BS, Hopkins Co., to Corum Bros., Madisonville, $22,517. Bids Oct. 19, awarded Nov. 13. Noted Sept. 27.

Kentucky—State Hy. Comn., Frankfort, rein.-con. paving 0.165 mi. Winchester Ave., Ashland, Boyd Co. (*) and rock asphalt paving 0.426 mi. West Main St., in Lexington, Fayette Co. (*), to Carey-Reed Co., Lexington, $16,180 and $17,374 respectively***traffic bound limestone paving 2.959 mi. Princeton-Shady Grove Rd., Caldwell Co., and gravel surfacing 3.521 mi. Benton-Birmingham Rd., Marshall Co., to N. E. Stone & Co., Madisonville, $11,448 and $5,101 respectively***grading, draining 3.023 mi. Brandenburg-Battletown Rd., Meade Co., (*) to J. Oman, Jr., Acklen Park, Nashville, Tenn., $23,984***3.257 mi. Howardstown-Kaywick Rd., Nelson Co., (*) to F. J. Snider, Elizabethtown, $27,734***two 30 ft. rein.-con. deck girder span bridge at Louellen on Harlan-Cloversplint Rd., Harlan Co., (*) to Ky.-Va. Stone Co., Middlesboro, $7,329***traffic bound limestone on sandstone paving 5.433 mi. Hindman-Lackey Rd., Knott Co., (*) to S. H. Hart Constr. Co., Lexington, $22,500. Grand total $131,650. All projects marked (*) are P.W.A. projects. Rejected bids navigation lighting system for Ohio River toll bridge between Henderson, Ky., and Evansville, Ind. MP 8-TB-2, Henderson Co. (*), to be readvertised. Noted Oct. 25 and Nov. 1.

†Maine—Dpt. Agriculture, Pub. Rds., Troy N. Y., grading, surfacing Big Moose Island-Wonsequeak Harbor Rd., Acadia Natl. Park, to Lane Constr. Corp., Meriden, Conn. Est. $132,195. Bids Oct. 30.

Maine—State Hy. Comn., L. D. Barrows, ch. engr., gravel surfacing 1.1 mi. NRH 259-A "N" Indian Twp., by force account; bituminous macadam surfacing 0.69 mi. NRH 91-H "Y" Orrington, to Bridge Constr. Corp., Hazardville, Conn., $23,980. **P.W.A.** Bids Oct. 24.

Minnesota—State Hy. Comn., St. Paul, grading 2 mi. State Project 1-166-22-4-A, F.P. 7-G, to R. J. Maturi, Chisholm, $48,751***4.6 mi. State Project 22-39-24-1, NRH and M 366, D and E, to Lobnitz Bros., Willmar, $13,488***4 mi. State Project 23-185-21-3A, NRH and M 503-A and B, to Strom Constr. Co., Moorhead, $24,921***4.3 mi. S.P. 55-142-23-2B, NRS 495-B, to DeRuyter Bros., Willmar, $18,170. Grand total $105,330. **P.W.A.** Bids Nov. 2. Noted Oct. 25.

Minnesota—State Hy. Dpt., St. Paul, constructing, concrete paving 0.2 mi. State Project 16-9-45-6 NRM 61-C, to McCree & Co., 918 New York Bldg., St. Paul, $32,114. **P.W.A.** Bids Nov. 9. Noted Nov. 1.

Mo., St. Louis—Bd. P. Serv., City Hall, grading, rein.-con. paving 13,850 sq.yd. River Des Peres Parkway and refined asphalt paving 720 sq.yd. 13th St., to Stiers Bros. Constr. Co., 2944 Magazine St., $101,825 and $5,619 respectively est. $105,000 and $5,800 respectively***rein.-con. paving 27,150 sq.yd. River Des Peres Parkway, to Perkinson Bros. Constr. Co., 3237 Carter Ave., $125,023 est. $129,400. Grand total $232,467. **P.W.A.** Bids Nov. 13. Noted Oct. 25.

Nebraska—Dpt. Roads & Irrigation, State Office Bldg., Lincoln, to J. E. Tift, Grand Island, grading 4.3 mi. road in Custer Co., $20,125***to L. S. Noble Constr. Co., 1246 South 14th St., Omaha, 0.4 mi. Polk Co., $16,877***to Roberts Constr. Co., 6051 1st Natl. Bank Bldg., Lincoln, paving 0.5 mi. Colfax Co., $13,757***to W. A. Biba Eng. Co., Geneva, sand graveling 2.3 mi. Rock Co., $2,035***to E. D. Zimmerman & Son, Kearney, 10.9 mi. Polk Co., $5,930***to Central Bridge & Constr. Co., Wahoo, 5 mi. Thurston Co., $19,895***to M. M. Liggett, Benedict, 11.6 mi. Dawes Co., $4,726***to W. Krotter & Son., Stuart, 4.4 mi. Boyd Co., $1,844***to A. L. Cook, Ottawa, Kan., grading 6.1 mi. Fillmore Co., $15,749; 8.1 mi. Pawnee Co., $30,666; 5.1 mi. Nemaha Co., $8,969***to Abel Constr. Co., 900 North 16th St., Lincoln, and Theisen Bros., Osmond, 1.1 mi. Fillmore Co., $34,433; 2.8 mi. Hall Co., $8,558***to Yant Constr. Co., 917 North 45th St., Omaha, 4.1 mi. Washington Co., $19,637. Grand total $203,201. Bids Nov. 16.

Nevada—State Hy. Comn., Carson City, grading, draining, crushed graveling 8.54 mi. road in Lyon Co., to Jones & King, Hayward, Calif., $63,499***8.03 mi. Churchill Co., to Isbell Constr. Co., Carson City, $82,587***11.74 mi. Humboldt Co., to Utah Constr. Co., Ogden, Utah, $68,289. Grand total $214,375. **P.W.A.** Bids Nov. 14.

New Hampshire—State Hy. Dpt., Concord, F. E. Everett, ch. engr., crushed gravel surfacing 2.682 mi. South Side Rd., Keene, Marlboro, Dublin, Cheshire Co., 24 ft., to Lane Constr. Corp., 37 Colony St., Meriden, Conn., $97,709. Est. $100,000. **P.W.A.** Bids Nov. 15.

New Hampshire—State Hy. Dpt., Concord, gravel surfacing 0.748 mi. Stark Hy., Hopkinton, Merrimack Co., 21 ft., and 1.194 mi. Daniel Webster Hy., Campton, Grafton Co., 24 ft., to Littleton Constr. Co., Littleton, $8,261 and $25,283 respectively, est. 10,000 and $31,000 respectively***3.696 mi. South Side Rd., Raymond-Epping, Rockingham Co., 24 ft., to Lane Constr. Co., 37 Colony St., Meriden, Conn., $66,896, est. $100,000. Grand total, $100,440. **P.W.A. Bids Nov. 8. Noted Nov. 1.**

New York—A. W. Brandt, comr. Hys., Albany, concrete paving 1.8 mi. roads in Queens and Nassau Counties, to Johnson, Drake & Piper, Inc., Freeport, $259,438 est. $295,343***3.27 mi. Columbia Co., to A. Colarusso & Son, Inc., Hudson, $130,374 est. $160,073***road in Erie Co., to Bero Eng. & Constr. Corp., North Tonawanda, $208,447 est. $217,204***5.94 mi. Orange Co., to A. E. Ottaviano, Inc., Croton-on-Hudson, $210,925 est. $265,699***grading structures 1.17 mi. Queens Co., to Kennedy & Smith, Inc., 131-20 41st Ave., Flushing, $110,397 est. $139,965***graveling 5.51 mi. Cattaraugus Co., to J. J. Petrossi, Jr., 6 State St., Rochester, $31,234 est. $41,524***4.33 mi. Chemung Co., to Bolton, Suits, Bolton & Gibbs, Watkins Glen, $27,994 est. $30,492***4.92 mi. Livingston Co., to M. E. Colle, Inc., LeRoy, $31,388 est. $39,691***2.36 mi., Sullivan Co., to Richard Hopkins Co., North Pearl St. and Loudenville Rd., Albany, $21,390 est. $23,424***road in Oswego Co., to Street Bros. Constr. Co., Inc., 921 East Hiawatha Blvd., Syracuse, $20,868 est. $28,756***4.82 mi. Genesee Co., to J. M. Murray, 42 East Ave., Rochester, $23,223 est. $33,562. Grand total $1,075,678. **P.W.A.** Bids Oct. 30 and Nov. 13. Noted Oct. 25 and Nov. 1.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., recurbing West 54th St., to Agmac Co., Inc., 15 Park Row, $17,544***Academy St., to S. B. Contg. Co., 139 156th St., $22,628***granite repaving West 59th St., and granite block repaving 1st Ave., to W. J. Fitzgerald, Grand Central Terminal, $26,509 and $208,201 respectively***asphalt block repaving West 59th St., to E. T. Barry, 126-06 139th St., Laurelton, $17,722. Grand total $292,604. Bids Oct. 16. Noted Oct. 11.

N. Y., Waterloo—City, bituminous surfacing several streets, day labor. TERA project. Est. exceeds $25,000.

O., East Cleveland—City, widening and sheet asphalt on concrete paving 4,000 sq.yd. East 152nd St., between Woodworth and Coirt Rds., to Riley Bros. Constr. Co., 9521 Woodland Ave., Cleveland, $19,200. Est. $26,000. **P.W.A.** M. Garnett, city engr.

Oregon—State Hy. Comn., Portland, grading, surfacing 0.42 mi. Church Section, Cape Vlanco Secondary Hy., Curry Co., to F. C. Dillard, Medford, $9,471***Unit A, Klamath Rock Production Project on Dalles California and Green Springs Hy., to Newport Constr. Co., Governor Bldg., Portland, and to Kern & Kibbe, 290 East Salmon St., Portland, $20,000***2 units Modoc Point and Keno Sections, to R. I. Stuart & Sons, Medford, $19,000. Grand total $48,417. Bids Nov. 1.

Oregon—State Hy. Comn., Portland, constructing McNary-Oak Creek Section of Independence Hy. and Yamhill River South Creek Section, Dallas-Coast Hy., to T. Arenz, Guaranty Bldg., Portland, $29,993 and $81,994 respectively. Bids Nov. 1.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, bituminous penetration on native stone paving 0.77 mi. Route 22036 Lykens Twp., Dauphin Co., to A. A. White, Box 203, Lebanon, $15,655***bituminous surface course Spec. "B" either a native stone or modified broken stone base paving 2.76 mi. Route 55013, Sect. 1, East and West Brunswick Twp., Schuylkill Co., to C. F. Goeringer Constr. Co., 296 Madison St., Wilkes-Barre, $82,203. **P.W.A.** Bids Oct. 11. Noted Oct. 4.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, rein.-con. paving also bit. surface course Spec. "E" paving 1.7 mi. Route 166, Sect. 7-A, Forks Twp., Northampton Co., to H. R. Miller, Box 1235, Lancaster, $61,290. **P.W.A.** Bids Oct. 26. Noted Oct. 18.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, rein.-con. widening and paving 2.53 mi. Route 146, Sect. 1, West Norriton and Lower Providence Twps., Montgomery Co., to Dalton Bros., Inc., Paoli, $74,727. **P.W.A.** Bids Nov. 9. Noted Nov. 1.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, bituminous surface course Spec. "E" on broken stone paving 2.48 mi. Delaware Co., to Hutchinson Constr. Co., 138-40 South Springfield Rd., Clifton Heights, $54,128***Spec. "E" on broken stone base, and rein.-con. paving street intersections 3.13 mi. Delaware Co., to Union Paving Co., 1227 North Broad St., Phila., Pa., $71,059***bituminous surface course, Spec. "B" on native stone paving 1.61 mi. Luzerne Co., to N. B. Putnam, 204 Transfer St., Fort Wayne, Ind., $37,583, all foregoing P.W.A. Projects***rein.-con. bridge and approaches, Bridge No. 1, Route 268 Franklin Twp., Greene Co., to W. K. Reed, Waynesburg, $8,654, state project. Grand total $171,424. Bids Nov. 16. Noted Nov. 8.

R. I., Providence—City, bituminous macadam paving and regulating South Water St., to John Ambrose Constr. Co., Inc., 1100 Pontiac Ave., $40,642. **P.W.A.** Bids Nov. 5.

South Carolina—State Hy. Dpt., Columbia, removing old gutter and replacing with concrete, 5 blocks Main St., Columbia, removing old pavement and replacing with sheet asphalt on concrete base 2 blocks same street, etc., NRM 45, Sect. C, parts 1 and 2, Richland Co., to Simmons-Mayrant Co., Charleston, $24,230; widening concrete culverts, etc., State Route 2, NRH 159 and NRH 279, and NRH 282, Dorchester Co., to C. Y. Thomason, Greenwood, $17,503. Bids Nov. 13, awarded Nov. 20. Noted Nov. 1.

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†*Federal Government.*

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Streets and Roads (Continued)

Texas—G. Gilchrist, state hy. engr., Austin, grading, drainage structures 6.548 mi. State Hy. 74-A, S.P. 1083-B, Lampasas Co., to Hannah & Hall, P. O. Box 994, Waco, $59,601, est. $60,000; iron ore top soil base with road oil surface treating 4.027 mi. State Hy. 15, S.P. 1081, Wood Co., to Austin Road Co., 1813 Clarence St., Dallas, $29,382, est. $30,000. Bids Nov. 8.

Texas—G. Gilchrist, state hy. engr., Austin, triple asphalt on caliche base course surface treating 6.863 mi. State Hy. 7, NRH 502 B and C, Lubbock and Lynn Counties, and 14.707 mi. State Hy. 7 and Loop, NRH 685-A and S.P. 755-A, Garza Co., to Field Bros., Myrick Bldg., Lubbock, $50,774 and $133,843 respectively, est. $60,000 and $150,000 respectively ***grading, drainage structures 9.057 mi. State Hy. 1, NRH 245-D, Hudspeth Co., to Hannah & Hall, P. O. Box 994, Waco, $39,098 est. $50,000***7.108 mi. State Hy. 43, NRH 481-B, Rusk Co., and 6.647 mi. State Hy. 40, NRH-M 353 C and E, Cherokee Co., to Jas. Spencer & Sons, Gilmer, $72,725 and $48,085 respectively est. $80,000 and $60,000 respectively***iron ore top soil base course with road oil surface treating 3.855 mi. and iron ore top soil base course with triple asphalt surface treating 1.191 mi. State Hy. 40, NRH-M 566 D, Cherokee Co., to Russ Mitchell, 2701 Texas Ave., Houston, $35,164 est. $40,000. Grand total $379,689. **P.W.A.** Bids Nov. 8.

Virginia—State Hy. Dpt., Richmond, improving roads in Alleghany Co., to W. W. Tuck & Son, Virgilina, $19,512***Giles Co., to H. D. Crowder, Wytheville, $9,235***Roanoke Co., to G. T. Franklin & Sons Co., Bassett, and Sam Finley, Roanoke, $28,377***Augusta Co., to R. W. Moore & Co., Staunton, $90,750*** in city of Martinsville, to F. L. Showalter, Lynchburg, $4,265. Grand total $152,139. **P.W.A.** Bids Nov. 15. Noted Nov. 8

Washington—L. V. Murrow, dir. Hys., Olympia, concrete widening, asphaltic concrete repaving existing 20 ft. concrete pavement and widening bridge on 4.004 mi. road in King Co., to Northwest Constr. Co., 3950 6th Ave., N.W., Seattle, $184,320. **P.W.A.** Bids Nov. 7.

Wash., Bremerton—City, furnishing materials for paving High, Veneta and Chester Aves., 9th, 10th and 11th Sts., and materials for sidewalks and gutters on 4th and 5th Sts. and Olympic Ave., to Parker Lumber Co., Bremerton, $39,151. Work by Washington Emergency Relief Administration labor.

West Virginia—State Hy. Comn., Charleston, improving roads in Greenbrier Co., to O. Vecellio, Itman, $11,110***Mineral Co., to Solazo Constr. Co., Riverton, $66,704***Webster Co., to M. K. Topping, Ironton, O., $34,222***Tyler Co., to C. Sargent, Middlebourne, $43,551***Ohio Co., to Consolidated Eng. Co., 17th and Warren Sts., Wheeling, $20,340. Grand total $175,887. Bids Nov. 20. Rejected bids Nov. 20 improving roads in Marshall and Boone Counties. Noted Nov. 15.

Wisconsin—State Hy. Comn., Madison, grading, draining 1.79 mi. road in Ozaukee Co., to J. O'Keefe, DePere, $31,164. **P.W.A.** Bids Nov. 7. Noted Oct. 25.

Wisconsin—State Hy. Comn., Milwaukee, grading, draining road in Washington Co., to F. Mashuda, Milwaukee, $34,783; crushed graveling same road, to J. A. Zielke, Oakfield, $9,738. **P.W.A.** Bids Nov. 7. Noted Oct. 25.

†Wyoming — Pub. Rds., Denver, Colo., oil processing roadway by plant mix method 24.296 mi. road in Yellowstone Natl. Park, to Taggart Constr. Co., Cody, $99,836.

Ont., Schumacher—Dpt. Northern Development, Parliament Bldgs., Toronto, clearing, grading, widening 3.65 mi. road between Schumacher and South Porcupine, to L. Mascisli, 77 3rd Ave., Timmins, approximately $60,000.

EARTHWORK, IRRIGATION DRAINAGE AND WATERWAYS

PROPOSED WORK

Calif., Sausalito—Golden Gate Yacht Harbor Ltd., 800 Mills Bldg., San Francisco, plans being completed yacht harbor, involving boat landings, boat houses, swimming facilities, dredging, clubhouse, etc. $150,000 or more. W. Polk Co., 277 Pine St., San Francisco, archt. Noted Nov. 2, 1933.

Pa., Alburtis—Borough plans constructing dam across east branch of Swope Creek in Lower Macungie Twp. Project approved by Pennsylvania Dpt. Waterways.

†Tenn., Pickwick Landing—Tennessee Valley Authority, Knoxville, authorized construction Pickwick Dam on Tennessee River, forming lake 53 mi. long, near here, dam will be 7,710 ft. long, incl. 2 earth dam sections, 600 ft. navigation lock, 110 ft. wide. $22,000,000. U. S. Engineers, Nashville, preparing plans. Noted Sept. 13.

Tex., Orange—Orange Water Co., Inc., c/o C. C. Leedy, agt., rejected bids pumping plant, water system to water 40,000 acres land. $489,000. W. B. Gregory & B. Bernard, Orange, engrs. P.W.A. project. Noted Oct. 18.

BIDS ASKED

†Calif., Alameda—Dec. 13, by U. S. Coast Guard, Wash., D. C., constructing 1,528 ft. steel sheet pile bulkhead, boat basin, launchway, timber and concrete anchorages, at Coast Guard Base 11, Government Island. Former bids rejected.

†Maryland—Dec. 6, by U. S. Eng., 332 Post Office Bldg., Baltimore, dredging 58,900 cu.yd. in Twoitch Cove, Big Thoroughfare River and Tylers River at Smith Island.

Nebraska—Dec. 10, by Loup River Public Power Dist., Columbus, completing siphons at Stas. 184 plus 25 and 415 plus 07, near Genoa and weirs at Stas. 1363 plus 00 and 1941 plus 00, near Columbus, incl. 64,500 cu.yd. excav., 14,700 cu.yd. backfill, 90 M ft. B.M. wood sheet piling. P.W.A. project.

N. J., Point Pleasant—Dec. 3, by Dpt. Commerce & Navigation, State House, Trenton, creosoted timber bulkheads and untreated timber bulkhead in Bay Head-Manasquan Canal, V. Gelineau, 15 Exchange Pl., Jersey City, engr.

N. Y., Brooklyn—Dec. 5, by R. V. Ingersoll, pres. Brooklyn Boro, Boro Hall, dredging 27,500 cu.yd. in Wallabout Canal.

†Tenn., Memphis—Dec. 7, by U. S. Eng., Box. 97, constructing 2,273,000 cu.yd. earthwork in White River Levee Dist.

CONTRACTS AWARDED

Calif., Los Angeles—Bd. Supervs. Flood Control Dist., 250 South Bway., constructing Unit 7, San Gabriel River outlet, Proposal 2, to Shannahan Bros., Constr. Co., 6181 Eastern Ave., $57,262. Bids Oct. 15. Noted Oct. 4.

†Ill., Joliet—U. S. Eng., Post Office Bldg., Chicago, constructing retaining wall and widening channel in Des Plaines River, to E. P. Evans Co., $1446 West Randolph St., Chicago, $49,451. Bids Oct. 23. Noted Oct. 4.

†Ind., Indiana Harbor—U. S. Eng., Chicago, Ill., dredging 1,599,990 cu.yd. from Indiana Harbor, to Mackie-Thompson Tamm, Inc., 228 North LaSalle St., Chicago, Ill., $598,396. Bids Nov. 7. Noted Oct. 18.

†Ia., Muscatine—U. S. Eng., Rock Island, Ill., repairing Dennis Foley and John Estle Levees on Cedar River, to Bolhman & Stear, Manlius, $3,250. Bids Oct. 31.

Louisiana—State Bd. Engineers, New Orleans, constructing 54,000 cu.yd. Wilson Point-Elton Slough Drainage Canal about 6 mi. north of Lake Providence and 27,000 cu.yd. Gassoway Canal 1 mi. below Louisiana-Arkansas State line, both East Carroll Parish, to Granger Constr. Co., Tallulah, at 6.9c. per cu.yd.; 152,000 cu.yd. Lake St. Peter Diversion Canal, 4 mi. south of St. Joseph in Tensas Parish, to L. E. Harris, Ferriday, 8c. per cu-yd., all foregoing in 5th Louisiana Levee Dist. Noted Nov. 1.

†Louisiana—U. S. Eng., New Orleans, dredging 6,500,000 cu.yd. from Whiskey Bay Pilot Channel, St. Martin Parish, to McWilliams Dredging Co., Canal Bank Bldg., New Orleans, $607,100. Bids Nov. 1. Noted Oct. 11.

†Louisiana—U. S. Eng., Prytania St. and River Front, New Orleans, to Edward E. Morgan Co., Inc., Jackson, Miss., constructing 22,000 cu. yd. levee work, Item R 1041 Lower Henderson Levee, $4,048; 90,000 cu.yd. Item R 1040, Ramap-Henderson Levee, $16,560***to McWilliams Corp., Canal Bank Bldg., New Orleans, 120,000 cu.yd. Item R 1033.6, Upper Orange Farm Levee, $13,740; 145,000 cu.yd. Item R 1011, Myrtle Grove Levee, $16,603; 60,000 cu.yd. Item R 1001, Levee Oak Levee, $7,557 ***to A. J. Hanson Co., Inc., Alexandria, 30,000 cu.yd. Item 1036.5, Nairn-Vaccaro Levee, $8,610***to J. Riess, 808 New Orleans Bank Bldg., New Orleans, 62,000 cu.yd. Item R 1029.8, Little Texas Levee, $22,134***to A. A. Buras, 3128 DeSoto St., New Orleans, 35,000 cu.yd. Item R 1059, Venice Levee, $7,963***to Schoenberger & Buras, 3128 DeSoto St., New Orleans, 70,000 cu.yd. Item R 1057.6, Upper Venice Levee, $19,600, all foregoing on Mississippi River in Barataria Levee District***to Swinney & Coelman, Baton Rouge, 27,000 cu.yd. Item L 1016.6, Upper Pointe-La-Hache Levee, $4,104; 33,000 cu.yd. Item L 1004, Belair Levee, $5,016; 28,000 cu.yd. Item L 989, English Turn Levee, $4,256***to Edgar J. Kelly, 3132 Louisiana Parkway, New Orleans, 17,000 cu.yd. Item L 1018, Davant Levee, $5,916, all foregoing Lake Borgne Levee Dist. Grand total $136,107. Bids Oct. 22.

Maryland—Comrs. Anne Arundel Co., Court House, Annapolis, J. A. Cromley, engr., constructing 2,960 lin.ft. creosoted timber bulkhead and 738 lin.ft. masonry wall, Bay Ridge, to State Contg. & Landscape Co., 36th and Roland Ave., Baltimore, $38,507. Est. $40,000. Award subject to sale of bonds. Noted Sept. 27.

Maryland—Comm. of Anne Arundel Co., Court House, Annapolis, J. A. Bromley, engr., constructing 2,331 lin.ft. creosoted timber bulkhead, Masons Beach, to Brundage & Crandle Co., Sudley, $21,394 est. $20,000, award subject to sale of bonds; constructing 1,217 lin.ft. creosoted timber bulkhead, Franklin Manor Beach, to E. R. P. Smith, Hyattsville, $15,153 est. $15,000, award subject to sale of bonds. Bids Oct. 23.

†Mass., South Boston—Dpt. Commerce, Air Navigation Div., Municipal Airport, East Boston, constructing earthen dike, to Richard Van Buren, Hudson, N. Y. Bids Oct. 8, awarded Nov. 20.

Nebraska—Platte Valley Power & Irrigation Dist., North Platte, 7 radial gates for Sutherland Irrigation Project, to Omaha Steel Wks., 609 South 48th St., Omaha, $19,356***7 skimmer weir gates, to R. Hardesty Mfg. Co., 3063 Blake St., Denver, Colo., $7,974***4 roller bearing gates with frames, guides and operating machinery, to Phillips & Davies, Inc., Kenton, O., $27,000. Grand total $54,330. P.W.A. Bids Nov. 1. Noted Oct. 25.

†Pa., Pittsburgh—U. S. Eng., raising 2 lock-keepers houses to permit constructing new foundation at Lock 5, Allegheny River, Freeport, to Peoples House Moving Co., 3763 Orpwood St., $2,917.

†Virginia and Maryland—U. S. Eng., 1068 Navy Bldg., Wash., D. C., dredging 37,600 cu. yd. from Occoquen Creek, Va., and 43,400 cu. yd. from Breton Bay, Md., to Norfolk Dredging Co., Norfolk, Va., $11,129. Bids Oct. 26. Noted Oct. 25.

UNCLASSIFIED

PROPOSED WORK

Calif., Sausalito — YACHT HARBOR — See "Earthwork, Irrigation, Drainage, Waterways."

Ill., Sesser—COAL MINING STRUCTURES —Brewerton Coal Co., plans repairing and altering coal mining structures, buildings, etc. To exceed $28,000.

Kan., Emporia—GAS DISTRIBUTION SYSTEM—City defeated $345,000 bonds, for gas distribution system and will not complete application for P.W.A. funds. Total est. $1,000,000. E. T. Mendel, city clk. Black & Veatch, 700 Mutual Bldg., Kansas City, Mo., engrs.

Massachusetts—AIRPORT and RACE TRACK —Boston Metropolitan Airport, Inc., c/o Mark Linenthal, 250 Devonshire St., Boston, engr., making preliminary plans constructing airport extension, in what is now known as "The Fowl Meadows," in Neponsit River Valley, covering 1,568 acres, also 1¼ mi. horse racing track, grandstand, clubhouse to accommodate 30,000 people, administration building, paddocks, jockey house, stables, parking, area, railroad siding, loading platforms, airway beacon. Est. about $2,500,000.

Mo., St. Louis—PLAZA DEVELOPMENT—City Plan Comn., H. Bartholomew, consult. engr., plans developing Aloe Plaza on territory bounded by 18th, 20th, Market and Chestnut Sts., $190,000. Plan includes central fountain to be designed by C. Miles, Swedish sculptor, to cost about $45,000. Municipal Art Comn. tentatively approved plans.

N. Y., Mariners Harbor—PIERS—Shooters Island Shipbuilding Co., 2855 Richmond Terrace, Port Richmond, plans repairing and altering piers. To exceed $30,000.

N. Y., Brooklyn—BULK OIL STORAGE and TANKS—Chapman Docks, Inc., 1105 Metropolitan Ave., plans bulk oil storage and tanks, Gardiner and Maspeth Aves. $30,000. M. Cafiero, 391 Fulton St., archt.

N. Y., Brooklyn—COAL POCKET, etc.—Flatbush Coal Co., McDonald Ave. and Avenue S, will award contract in February without competition for coal pocket, coal storage, etc., McDonald Ave. and Avenue S. $28,000 with equipment. W. Neill, 405 Lexington Ave., New York, archt. Noted Nov. 15.

N. Y., Coney Island (Sta. Brooklyn)—AMUSEMENT PARK—J. Bonsignore, 531 6th St., Brooklyn, plans altering amusement park, incl. reconditioning scenic railway, and other amusement devices, West 8th St. and Surf Ave. To exceed $28,000.

N. Y., New York—TOMB and BURIAL VAULT—Holy Cross Armenian Apostolic Church, 578 West 187th St., plans tomb and vault, 578 West 187th St. $28,000. H. Exerjian, 148 East 33rd St., archt.

Oregon—TELEPHONE LINES—Pacific Telephone & Telegraph Co., 352 Oak St., Portland, plans expending $1,650,000 during 1935 for lines and other improvements.

BIDS ASKED

Oklahoma—OIL DEVELOPMENT—See "Contracts Awarded."

Texas—OIL PROPERTIES DEVELOPMENT —See "Contracts Awarded."

Ont., Toronto—DOCK—Dec. 4, by Secretary Dpt. P. Wks., Ottawa, constructing dock at Marginal Way, Toronto Harbor. $546,000. K. M. Cameron, Ottawa, engr.

CONTRACTS AWARDED

†Calif., San Francisco—CONVERTING LIGHTSHIP—Superintendent Lighthouses, converting from coal burner to oil burner Lightship 83, to Moore Dry Dock Co., Balfour Bldg., $65,965. Bids Aug. 7. Noted July 26.

†Calif., San Francisco—ELECTRIC SYSTEM —Con. Q.M., completing underground electric system at Fort Mason, to A. Soda & Son, 554 42nd St., Oakland, $38,370. Bids Oct. 15.

†D. C., Wash. — SIGNAL SYSTEM — Treas. Dpt. at office Sup. Archt., Wash., D. C., signal system in Dpt. Justice Building, to H. P. Foley, 2020 Eye St., $57,382.

Ind., Indianapolis—BROADCASTING STATION —State, A. G. Feeney, dir., tower, 200 ft. high, for State Police Dpt. Broadcasting Station, at State Fair Grounds, to International Derrick & Equipment Co., Connersville. Noted Nov. 8.

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†Federal Government.

Unclassified (Continued)

†Mass., South Boston—RADIO TOWERS—Dpt. Commerce, Air Navigation Div., Municipal Airport, steel radio towers, to Sven Benson, 151 Washington St., Arlington, approximately $2,000.

Mo., Robertson—HANGAR—Lambert-St. Louis Flying Field, 110th Observation Squadron, 40x60 ft., brick hangar addition, concrete foundation, own forces***iron work, to LaSalle Iron Wks., 3110 LaSalle St.***reinforcing steel, to LaClede Steel Co., Arcade Bldg., St. Louis***steel windows, to Lasar Mfg. Co., 1313 North 16th St.***millwork, to Fox Bros., Mfg. Co., 2717 Sidney St., St. Louis***and concrete work, to H. A. Dailey, Inc., 4107 Clayton Ave., St. Louis.

N. J., Linden—STORAGE TANKS—Sinclair Refining Co., 45 Nassau St., New York, oil storage tanks at Tremley Point, near here, to Chicago Bridge & Iron Wks., 165 Bway., New York. Est. exceeds $30,000.

N. Y., Brooklyn—COAL POCKETS—Audley Clark Co., 527 Smith St., constructing coal pockets, concrete, Smith and Centre Sts., to Nicholson Co., 405 Lexington Ave., New York. Est. $28,000. Noted Nov. 15.

Oklahoma—OIL DEVELOPMENT—Larkins-Warr Trust, c/o W. E. Brown, Tulsa, developing oil properties, incl. drilling, oil storage, etc., in Pittsburgh Co. and other locations, day labor and separate contracts. To exceed $50,000.

Okla., El Reno—SWIMMING POOL—City, swimming pool, to Cedric Wilson, Iola, Kan., $22,000. Est. $25,000. Noted Apr. 19.

Texas—OIL PROPERTIES DEVELOPMENT—Delta Oil Co., c/o G. Kean, Cooper, pres., developing oil properties, day labor. Est. about $28,000. Noted Nov. 15.

Va., Richmond — WHARVES — City, raising city wharf walls to level of municipal warehouse, to Hankins & Potter, Richmond, $6,160. Bids Oct. 15.

†Va., Quantico—HANGAR—Yards & Docks, Navy Dpt., Wash., D. C., relocating and addition to Hangar 29, at Marine Base, Spec. 7082, to W. P. Thurston, 4th and Byrd St., Richmond, $38,980. Bids Oct. 31. Noted Oct. 25.

†T. H., Pearl Harbor—HANGAR—Yards & Docks, Navy Dpt., Wash., D. C., seaplane hangar at Naval Flying Air Base, Spec. 7770, to Pioneer Constr. Co., 1160 Textile Tower, Seattle, Wash., $131,300. Bids Nov. 14. Noted Nov. 1.

MATERIALS AND EQUIPMENT

PROPOSED WORK

DREDGING MACHINE—**Council Bluffs, Ia.**—R. Jones, engr., Lake Manawa Reclamation Project, Council Bluffs, plans purchasing dredging machine for diking and dredging Lake Manawa, near here. $10,000 raised by Junior Chamber of Commerce.

†PIPE—**Fort Peck, Mont.**—U. S. Eng., Kansas City, Mo., rejected bids Nov. 7, 5,500 lin. ft. 3 and 4 in. steel pipe, for Fort Peck Dam. Will readvertise.

AUTO LICENSE TAG MATERIALS—**Trenton, N. J.**—State Purchasing Agent, rejected bids Oct. 29, auto license tag materials. $50,000. Will readvertise.

STONE, TAR, etc.—**Trenton, N. J.**—State Hy. Comn., Trenton, rejected bids Oct. 17, stone, tar, asphalt and snow plows, snow fence and posts. Will readvertise.

TANKS—**Buffalo, N. Y.**—Bardol Co., Inc., Marine Trust Bldg., plans installing two 500 or 550 gal. steel storage tanks for gasoline at 1050-1060 Main St. To exceed $1,000.

TANKS—**Buffalo, N. Y.**—Standard Oil Co. of New York, 1100 Elk St., plans installing four 500 gal. steel tanks at filling station, 1040 Main St.

COPPER SULPHATE—**Mayville, N. Y.**—S. E. Fitch, engr. Chautauqua Co., Falconer, bids early in 1935, 24 tons copper sulphate for purifying water in Lake Chautauqua. To exceed $1,000.

STREET SWEEPER, etc.—**Erie, Pa.**—City plans purchasing new motor street sweeper, also truck for City Hy. Bureau. $14,550. C. K. Pulling, Dept. City Eng., City Hall, engr.

BIDS ASKED

AIR COMPRESSOR—**Los Angeles, Calif.**—Dec. 10, by D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., furnishing, delivering 1 stationary type air compressor with induction motor, Spec. 1555, alternate same with synchronous motor (a) f.o.b. 410 Ducommon St., Los Angeles (b) f.o.b. cars Lone Pine (c) f.o.b. cars bidders shipping point. To exceed $2,000.

†SMALL MOTORS—**Wash., D. C.**—Dec. 3, by Yards & Docks, Navy Dpt., Wash., D. C., small motors for Dpt. Agriculture, Extensible Building.

CRUSHED AGGREGATE, GRAVEL, SLAG—**Indiana**—Dec. 4, by J. D. Adams, chn. State Hy. Comn., Indianapolis, 1,000-1,500 tons crushed aggregate, gravel or slag, f.o.b. Beardstown or delivered on State Rd. 29, 1,000-1,500 tons crushed aggregate, gravel or slag, f.o.b. Royal Center or delivered on State Rd. 29Q; 750-1,000 tons crushed aggregate or slag, f.o.b. Walkerton; 1,800-2,000 tons, f.o.b. Plymouth; 1,000-1,500 tons crushed aggregate, f.o.b. Parr; 750-1,000 tons, f.o.b. Lewiston; 750-1,000 tons, f.o.b. Enos; 1,000-1,500 tons delivered on State Rd. 31B; 800 wood guide posts, f.o.b. Waterloo.

DRAGLINE and DIPPER—**Muncie, Ind.**—Dec. 5, by City, C. E. Stewart, supt., 1 yard and 1½ yd. capacity combination gasoline powered dragline and dipper equipped with 50 ft. boom and machine equipped with caterpillar type traction. $16,000.

RAILS, etc.—**New York, N. Y.**—Dec. 11, Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, supply of special work (rails, frogs and switches) for Rapid Transit Railroads, Orders 65 and 66.

CRUSHED STONE—**Tennessee**—Dec. 22, by Dancey Fort, comr. Dpt. Finance & Taxation, Nashville, 500 tons crushed stone delivered at Henley's Switch and 500 tons delivered at Palmer. Spec. M-60.

†WINCHES—**Summitt, C. Z.**—Yards & Docks, Navy Dpt., Wash., D. C., taking bids motor and hand-operated winches for antennas at Naval Radio Station, Spec. 7800.

PUMP—**Toronto, Ont.**—Jan. 8, by Chairman Bd. Control, supplying and installing one 2,000,000 imperial gal. centrifugal sewerage pump, motor and appurtenances.

†Federal Government.

CONTRACTS AWARDED

CABLE—**Los Angeles, Calif.**—Dpt. Water & Power, 207 South Bway., lead covered insulated cable, f.o.b. cars or trucks, 257 East 3rd St., Spec. 1537, to General Cable Co., 939 East 4th St., $108,967. Bids Nov. 9, awarded Nov. 15. Noted Nov. 1.

CONDUCTOR, etc.—**Los Angeles, Calif.**—S. A. Joseph, purch. agt., 20,000 ft. 3-conductor, 2/0, 8/64 30% rubber, 7/64 lead, 2,300 V armored cable, f.o.b. Indio, to L. B. Marsh, 1290 Gaviota Ave., Long Beach, $26,160. Bids Nov. 9.

CROSS ARMS—**Los Angeles, Calif.**—D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., furnishing, delivering as desired creosoted cross arms f.o.b. 1622 East Slauson St., Spec. 1543, to Maydwell & Hartzell, 455 Coylton St., $6,697.

DRIFTER DRILLS—**Los Angeles, Calif.**—D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., furnishing, delivering 3½ in. drifter drills, Spec. 1518, to Ingersoll Rand Co., 1460 East 4th St., $4,700. Bids Oct. 12, awarded Nov. 15.

DRILL STEEL SHARPENER—**Los Angeles, Calif.**—D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., furnishing, delivering 1 air operated drill steel sharpener f.o.b. for forming shanks and sharpening bits on drill steel used in driving Mono Craters Tunnel, Spec. 1549, to Gardner-Denver Co., 845 East 61st St., $2,064. Bids Nov. 5, awarded Nov. 15.

INSULATORS — **Los Angeles, Calif** — S. A. Joseph, purch. agt. Metropolitan Water Dist., 306 West 3rd St., 2,500 cap and pin type porcelain suspension type insulators and 500 pin type 35 kv. porcelain insulators, f.o.b. Banning, Bid 29443, to Westinghouse Electric Supply Co., 905 East 2nd St., $5,938. Est. exceeded $5,000. Bids Nov. 6.

STEEL I-BEAM RIBS, etc.—**Los Angeles, Calif.**—Metropolitan Water Dist., S. A. Joseph, purch. agt., 306 West 3rd St., structural steel I-beam ribs, splice plates and base plates for tunnel supports, Bid 29223, to Commercial Shearing & Stamping Co., 5615 Santa Fe Ave., $42,360.

TRANSFORMERS — **Los Angeles, Calif.** — Metropolitan Water Dist., 306 West 3rd St., to Wagner Electric Co., 601 West 5th St., ten 50 kva. single phase, 50 cycle, 33,000-2300 volt transformers for Colorado River Aqueduct, option to purchase 6 to 50 additional in 3 months, ten 50 kva. transformers at $7,890; option granted to purchase 6 to 50 additional at $789; for 20 one hundred kva. transformers at $19,720; option granted 6 to 100 additional at $986. Bids Oct. 22. Noted Oct. 18.

†VENTILATORS, etc.—**Fort Oglethorpe, Ga.**—U. S. Eng., 1,150 ventilators for Civilian Conservation Corps., to C. M. McClung & Co., Knoxville, Tenn., at $3.90 each; 80 tanks and boilers, to Chattanooga Tank & Boiler Co., Chattanooga, Tenn., $7.10 each.

ELECTRICAL EQUIPMENT—**Evansville, Ind.**—City, W. H. Elmerdorf, supt. Streets, 2,200 ft. No. 4 and 6,000 ft. No. 6 conductor cable, to Boetticher & Kellogg, 149 1st Ave. Est. $9,500.

PIPE, etc.—**Hector, Minn.**—Village, 2,000 lin.ft. 4 in. c.i. main, 4 hydrants, 4 gate valves, tees, plugs, 1,000 lb. pig lead, to Crane Co., 356 Bway., St Paul, and to Waterous Co., 80 Fillmore Ave. E., St. Paul, $1,537. **P.W.A.** Noted Nov. 1.

PUMPS, etc.—**Keewatin, Minn.**—Village, 2 centrifugal pumps, to Worthington Pump & Mchy. Co., Duluth, Minn., $764***flow water meters, to R. H. Whitacre & Co., 205 South Robert St., St. Paul, $265***to primary tanks, to W. R. O'Connell, Keewatin, $353. Grand total $1,382. Bids Nov. 5.

†SAND, GRAVEL, etc.—**Vicksburg, Miss.**—U. S. Eng., Box 667, 200 cu.yd. sand and 400 cu.yd. gravel (coarse aggregate), to C. A. Parker & J. E. Morgan, Receivers for Parker Gravel Co., Box 305, Monroe, La., $1,217, Bids Nov. 12***gate valves and floor stands, to Hajoca Corp., Columbus, Ga., $199***pipe fittings, to National Cast Iron Pipe Co., Tarrant City, Birmingham, Ala., $73. Bids Nov. 3. Grand total $1,489.

†ELECTRICAL EQUIPMENT — **Gasconade, Mo.**—U. S. Eng., Mfgs. Exchange Bldg., Kansas City, conduits, wires, miscellaneous electrical equipment and supplies, Lots 1, 5 and 6, to Gertler Corp., 220 West 83rd St., New York, $178***Lots 2 and 4, to Graybar Electric Co., Inc., 1644 Baltimore Ave., Kansas City, $167***Lot 3, to General Electric Supply Corp., 1411 Walnut St., Kansas City, $102. Grand total $447. Bids Nov. 19.

†COMPRESSORS—**Montana**—U. S. Eng., 707 Postal Telegraph Bldg., Kansas City, Mo., 4 electrically driven air compressors with motor and receiver, f.o.b. Wiota, for Fort Peck Dam, to Curtis Mfg. Co., 1905 Kienlen St., St. Louis, Mo., $645. Bids Nov. 12, awarded contract Nov. 13.

†ELBOWS—**Fort Peck, Mont.**—U. S. Eng., Kansas City, Mo., forty-eight 3 in. 90 degrees elbows and twenty-four 3 in. 45 degree elbows Lot 2, and forty-eight 3 in. and sixteen 4 in. flanges Lot 3, for Fort Peck Dam, to Hajoca Corp., Rosslyn, Va., $37; sixteen 3 in. valves, Lot 4, to Mine & Smelter Supply Co., 1422 17th St., Denver, Colo., $96. Bids Nov. 7.

SEWER PIPE—**Springfield, O.**—City Manager, 3,780 ft. 30 in., 2,562 ft. 36 in. and 2,286 ft. 42 in. rein.-con. sewer pipe, to Price Bros. Co., East Monument St., Dayton, $28,515. Est. $33,937. **P.W.A.**

RAILS—**Roanoke, Va.**—Norfolk & Western R.R. Co., W. P. Wiltsee, ch. engr., Roanoke, 7,500 tons 131 lb. rails, to Carnegie Steel Co., Carnegie Bldg., Pittsburgh, Pa.; 2,500 tons, to Bethlehem Steel Co., Bethlehem, Pa. Owner will place rail by day labor. Est. about $340,000.

PAVING MATERIALS—**Bremerton, Wash.**—See "Streets and Roads."

PIPE—**Appleton, Wis.**—City, 590 ft. 21 in. and 480 ft. 39 in. concrete pipe, to J. Haug & Son, Appleton, $720 and $1,623 respectively. Bids Nov. 7.

PUMP—**Clear Lake, Wis.**—Bd. Water Comn., E. G. Hallen, secy., furnishing deep well pump, to Fairbanks Morse & Co., Park Sq., St. Paul, Minn., $1,102. Bids Nov. 11.

WATER PIPE—**Watertown, Wis.**—Municipality, 5,200 ft. 6 in. c.i. water pipe, to J. B. Clow & Sons, 201 North Talman Ave., Chicago, Ill.

FOREIGN

Australia—Government Railway Bd., **Adelaide**, having surveys made for locating standard 4 ft. 8½ in. gage railway between Port Augusta and Adelaide. $9,000,000***Australian Iron & Steel Ltd., **Port Kembla**, plans large addition and installing open hearth furnaces.

Australia—Jan. 7, by **Sidney** City Engineer supplying complete automatic control equipment for 3 boilers at Bunnering Power Station ***Jan. 7, by **Germiston** Municipal Engineer, supplying measuring and recording flow of sewerage***Jan. 25, by **Brisbane** City Engineer, for 18,750 k.w. turbo generators, and complete condensing plant, etc.

Australia, Victoria—Imperial Chemical Industries, Ltd., Milbank House, London S.W.I., London, England, plans hydrogenation plant. To exceed $1,000,000. (**Correction**—address of owner.) Noted Nov. 15.

British Guiana, Georgetown — Chairman of Commissioners Transport & Harbors Dpt., in market for 8,000 ties, 9 ft. long x 9 in. wide x 4½ in thick.

Egypt, Khartum—Dec. 17, by Irrigation Dpt., supplying heavy duty gear driven tractor and road planer. Tenders should be sent Air Mail, addressed to the Director.

England—Avery Ltd. plans by A. Marshall & Tweedy, Pilgrim House, Newcastle, constructing weighing machines, **Newcastle upon Tyne**, $400,000***J. J. Cassidy, Elephant & Castle Hotel, preparing plans manufacturing plant, **Market Drayton**, $600,000***Ingersoll-Rand Co. Ltd., plans by A. Clayton, 4 Clarence St., plant, **Manchester**, $500,000***Clifford & Clifford, 28 Ealing Rd., preparing plans 1,700 houses, **Wembly**, $2,415,000***Fairway Homes, Ltd., bids in December 940 houses, **Barnet**, $1,316,000***Spillers Ltd., making plans flour mill and factory, **Newcastle upon Tyne**, $1,200,000; Libby, McNeill & Libby, preparing plans milk condensing factory, in **Newcastle upon Tyne**, $300,000***S. Wolf & Co. Ltd., preparing plans factory on Hangar Lane, **Ealing**, $220,000***Premier Yeast Co., plans by Joseph & Co., 2 Paul's Bakehouse Court, plant in **London**, $310,000.

England—A. F. French, archt., 26 St. Nicholas St., making plans 500 houses, **Bristol**, $3,750,000***Unit Company Ltd., Prescott Rd., Knotty Ash, plans for 700 houses, **Liverpool**,

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Foreign (Continued)

$2,500,000***H. G. Jones Ltd., Plyyard Park, Bromborough, takes bids in December for 1,000 houses, **Birkenhead,** $1,450,000***I. Hill & Son Ltd., Lancaster Rd., Eccles, preparing plans 395 houses, **Salford,** $580,000***F. I. Smith, Bath Rd., Chippenham, preparing plans 1,000 houses, **Slough,** $1,500,000***Davis Estates Ltd., 350 High Rd., taking bids 350 houses, **Kilburn,** $610,000***Arthur Pickles, archt., Lord St., Halifax, preparing plans factory for G. H. Gledhill & Sons, Ltd., in **Hull,** $500,000***T. E. Smith, archt., Central Chambers, **Bolton,** preparing plans weaving plant for J. J. Johnston Ltd., $350,000***London Film Productions, Ltd., 22 Berkeley St., **London,** plans by F. E. Simpkins, Park Royal, new film studios, $1,500,000***Smethurst Industries Ltd., Deansgate Arcade, Manchester, preparing plans 230 houses, **Ollerton,** $2,500,000.

England—W. P. Robinson, engr., **Kingston-on-Thames,** takes bids soon widening Dorking Leatherhead Rd., $512,500***D. Balfour & Sons, 47 Victoria St., London, preparing plans sewerage scheme for Urban District Council, **Bagshot,** $345,000***R. W. Weeks, 75 Victoria St., London, preparing plans drainage scheme for city of **Weymouth,** $825,000***Dodd & Watson, 3 Central Chambers, Westminister, preparing plans sewerage scheme for Corporation of Luton, **London,** $1,635,000***I. H. Haiste, Middlegate Chambers, Lowgate, preparing plans water scheme for town of Pocklington, **Hull,** $255,000***Binnie, Deacon & Goulay, Artillery House, preparing plans water supply scheme for Bedfordshire County Council, **Westminister,** $760,000***Manchester **City** Council voted $510,000 addition to Royal Infirmary*** **Liverpool** City Engineer takes bids in December for Clarence Dock Power Station addition, $1,720,000 voted***Liverpool Gas Co., **Liverpool,** plans by Quiggan & Son, North House, Liverpool, new building, $500,000***A. P. Statham preparing plans for city hall, **St. Helens,** $500,000*****Southend** City Council voted $900,000 for extending promenade*** **Wallasey** City Council constructing promenade to Edmund Nuttall Sons, Ltd., Trafford Park, Manchester, $2,538,650*****Southampton** City Council constructing sewerage disposal plant at Slough, to Jackanan & Son Ltd., $644,955*****Hackney** Town Council awarded contract town hall, to Doce Ltd., Clondesley Pl., Islington, $524,875***National Coke & Oil Co. Ltd., **Manchester,** preparing plans distillation plant at Trafford Park, $350,000*****Gillingham** City Council voted $525,000 for new town hall***Metropolitan Water Bd., **London,** instructs own engineer to prepare plans for reservoir in Lee Valley, $4,750,000 voted***London County Council, **London,** awarded contract rebuilding Chelsea Bridge, to Holloway Bros. Ltd., Milbank, $1,555,000*****Colchester** City Council, constructing outfall sewer, to T. Jackson Ltd., Ripple Rd., Barking, $541,540***H. J. Paul, engr., Infirmary St., **Leeds,** preparing plans flood prevention works for River Ouse Catchment Bd., $2,730,000*****Leicester** City Engineer, bids in December for swimming baths, $400,000******Middlebrough** City Council votes $690,000 for Poole Sanatorium addition*****Ipswich** City Engineer plans for City Mental Hospital addition, $600,000***E. D. Lyons, 34 Vaughan Bldg., Ilford, preparing plans power house, **Wolverhampton,** $530,000.

India, Simla—Director General, Indian Store Dpt., Belevedere Rd., Lambeth, England, in market for 34½ tons copper rod and tubes and brass bars and rods; copper fire box plates for locomotives; 1836 steel tires for locomotives, coaches and cars.

Isle of Man, Douglas—City Engineer takes bids in December, widening promenade, $600,000.

Mexico—National Railways of Mexico, c/o Ministry of Rail Transportation Mexican Government, Mexico City, plans constructing new railway from Uruapam, State of Michoancan to Sihuatanejo on Pacific Coast. To exceed $5,000,000.

New Zealand, Wellington—Jan. 9, by Deputy Director Posts & Telegraph Dpt., supplying 500 gongs B.P.O. Type***Jan. 15, by **Christchurch,** City Engineer, supplying 3 sets 11,00 volt 3 phase, 50 cycle metalclad switchgear.

Scotland—James Miller, archt., Renfield St., Glasgow, plans school at **Leicester,** $350,000***A. Cullen, archt., **Hamilton,** plans 900 houses for city, $1,350,000 voted***Stirlingshire and Falkirk Water Bd., **Stirling,** plans 3,000 m.g. reservoir, $1,250,000 appropriated***County Council of Ross and Cromarty, **Dornie,** voted $1,500,000 for bridge, plans ready in December.

Scotland, Edinburgh—T. S. Tait, archt., takes bids in December administration office building, $2,125,000; sheriff court house, $500,000; and library, $1,000,000.

South Africa, Johannesburg—City Council awarded contract 15,000 kw. turbo-generator and condensing plant, to British General Electric Co., $235,430***Dec. 10, by T. H. Watermeyer, chn. South African Railways and Harbors Bd., 15 ton electric driven portal gib cranes for Port Elizabeth.

Union Socialist Soviet Republics—Commisariat of Heavy Industry, Moscow, or c/o Amtorg Trading Corp., 261 5th Ave., New York, steel mill at Krivoy Rog (Southern Ukrania) by day labor. To exceed $1,000,000.

Union Socialist Soviet Republics—Municipality, Moscow, or c/o Amtorg Trading Corp., 261 5th Ave., New York, plans replanning city to provide for scheme of radial streets and six circles intersecting, incl. revamping water and sewage systems, demolition work, street widening. To exceed $30,000,000.

Union Socialist Soviet Republics—Soviet Government, Moscow, or c/o Amtorg Trading Corp., 261 5th Ave., New York, constructing 100 motion picture theatres in various locations in Ukraine, by day labor. To exceed $5,000,000.

PUBLIC BUILDINGS

PROPOSED WORK

Calif., Ontario—Chaffey Union High School Dist. commissioned H. L. Pierce, archt., 1443 Mt. Pleasant St., Los Angeles, to prepare plans for 2 story, 62x252 ft., rein.-con. liberal arts building, incl. classrooms, laboratories and administration unit. $124,000. S.E.R.A. labor will be used on the project.

Mo., Liberty—Clay Co., bids in December, 3 story, basement, 87x117 ft. rein.-con., brick, Indiana limestone court house. $275,000. $75,500 allotted by P.W.A. F. D. Wallace, 114 West 10th St., Kansas City, archt. Wright & Wright, 400 1st Natl. Bank Bldg., Kansas City, engrs. Noted Oct. 18.

N. Y., Harpursville—Bd. Educ., plans will be ready about Nov. 25, 2 story, basement, brick, steel, central grade and high school. $173,000. P.W.A. project. R. R. Graham, 25 Prospect St., archt. E. E. Seelye & Co., 101 Park Ave., New York, engrs. Noted Apr. 26.

N. Y., Yorktown Heights—Bd. Educ., postponed taking bids until December, school. $310,000. Knappe & Morris, 192 Lexington Ave., New York, archts. P.W.A. project.

Pa., New Castle—City, election early in January to vote $3,750,000 bonds, constructing municipal light and power plant. G. H. Hoskins, city engr.

R. I., Newport—City, Dpt. P. Educ., bids in December, brick addition to Cranston St. School. $105,000. Monahan & Meikle, 255 Main St., Pawtucket, archts.

BIDS ASKED

Ala., Andalusia—Dec. 6, by J. G. Scherf, mayor, at office of City Clerk, construction of gas mixing and storage plant and gas distribution system, incl. 1 Butane-Air gas mixing plant, 10,000 c.f.h. maximum output; 1 liquid storage tank, 2,183 cu.ft. capacity; 1 gas storage tank, 3,730 cu.ft. capacity; 45,290.5 ft. 2 in., 7,396 ft. 3 in., 4,989.9 ft. 4 in. and 2,376 ft. 6 in. c.i. pipe; 33,368 ft. ¾ in., 1,720 ft. 1 in. and 860 ft. 1¼ in. galvanized steel services, 418 meters and regulators. C. A. McKeand & Associates, Troy, and City Hall, Andalusia, engrs.

†Ala., Mobile—Dec. 14, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing single attendants quarters at U. S. Quarantine Station.

†Calif., Claremont—Dec. 14, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office.

Calif., Long Beach—Jan. 2, by Bd. Educ., light steel frame, steel studs, and gunite exterior walls for James Russell Lowell School. $125,000. E. L. Mayberry, 3900 East 3rd St., archts.

Calif., Long Beach—Jan. 16, by Bd. Educ., rein.-con. repairs to John Dewey Vocational High School. Est. $125,000. V. Siebert, archt., and V. D. Hedden, engr., both 120 East 3rd St. Noted Aug. 9.

†D. C., Wash.—Dec. 5, by Treas. Dpt. at office Sup. Archt., Wash., D. C., miscellaneous changes at Institute of Public Health.

†Ga., Eastman—Dec. 19, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing Post Office.

Ill., Elgin—Dec. 17, by Bd. Educ., High School Bldg., sprinkler system in school. $8,750. P.W.A. project. E. E. Adell, Elgin, archt

†Ia., Cresco—Dec. 19, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office.

†Mass., Gurnet—Dec. 5, by U. S. Coast Guard, 408 Atlantic Ave., Boston, 1 story, 52x56 ft., and 14x22 ft., brick, steel, metal rain shed, at Coast Guard Station.

†Mass., Holyoke—Dec. 6, by Treas. Dpt. at office Sup. Archt., Wash., D. C., interior lighting fixtures in U. S. Post Office.

Mass., Taunton—Dec. 4, by Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, furnishing, installing liquid vaporizing extinguisher units at Taunton State Hospital. P.W.A. Project M-46 Docket 5440. To exceed $1,000. Kendall, Taylor & Co., 209 Columbus Ave., Boston, archts. Noted Oct. 18.

N. Y., Albion—Dec. 27, by Commissioner Correction, State Office Bldg., Albany, construction, heating, sanitary and electrical work for laundry building, cannery and service connections, Albion State Training School.

N. Y., Beacon—Dec. 6, by Commissioner Correction, State Office Bldg., Albany, construction sanitary and electrical work for Farm Buildings, at Matteawan State Hospital.

†N. Y., Cobleskill—Dec. 6, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Oct. 25.

N. Y., Creedmoor—Dec. 12 (extended date), by Dpt. Mental Hygiene, State Office Bldg., Albany, construction, heating, sanitary, electrical work and special electric fixtures for assembly hall and service connections at Brooklyn State Hospital, Creedmoor Div. Noted Oct. 25.

N. Y., Franklin Square—Dec. 10, by Bd. Educ., Hempstead, school. $291,000. Knappe & Morris, 192 Lexington Ave., New York, archts. Noted Sept. 6.

†N. Y., Massena—Dec. 10, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Oct. 25.

N. Y., Port Jefferson—Nov. 27, by D. Perry, archt., Port Jefferson, constructing high school for Bd. Educ., $280,000. Bidding restricted to contractors in Brookhaven or other Suffolk County Town to the east. Noted July 5.

N. Y., Seaford—Bd. Educ., bids after Jan. 1, school. To exceed $165,000. Knappe & Morris, 192 Lexington Ave., New York, archts. Noted Sept. 6.

N. Y., Wingdale—Dec. 12, by Commissioner Dpt. Mental Hygiene, State Office Bldg., Albany, ventilating work, diary barn, at Harlem Valley State Hospital.

O., Tiffin—See "Contracts Awarded."

†Pa., Darby—Dec. 17, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Feb. 9, 1933.

†Pa., Phila.—Dec. 20, by Treas. Dpt. at office Sup. Archt., Wash., D. C., repairing boilers at U. S. Mint.

†Tenn., Milan—Dec. 17, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Sept. 6.

Wash., Nespelem—Dec. 18 (extended date), by Dpt. Interior, constructing Colville Indian Agency Hospital, 1 and 2 story, 107x188 ft. hospital with 2 wings, housing 50 rooms. $180,000. Noted Nov. 8.

Wis., Oconto—Dec. 6, by Oconto County and City Hospital Assn., P. Musiwsen, secy., 2 story, 43x85 ft., brick, steel hospital addition. P.W.A. project. Derrick Hubert, 1065 Sheridan Rd., Menominee, Mich., archt.

†C. Z., France Field—Dec. 17, by Quartermaster Corps., Dpt. Quartermaster, Panama Canal Dpt., Quarry Heights, constructing field, company and bachelor office quarters, at France Field.

CONTRACTS AWARDED

Calif., Los Angeles—Bd. Educ., reconstructing home economics and cafeteria buildings at Thomas Edison Junior High School, to Atlas Constr. Co., 39 Congress St., Pasadena, $40,000; reconstructing, rehabilitating and strengthening Wadsworth St. School, 1025 East 38th St., to Herbert M. Baruch Corp., 625 South Olive St., $80,250. **P.W.A.** Awarded Nov. 8.

Calif., Ontario—See "Proposed Work."

†Calif., San Francisco—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing plague laboratory building, to M. E. Vukicevich, 866 Mission St., $9,975. Bids Nov. 8. Noted Nov. 1.

†D. C., Wash.—Yards & Docks, Navy Dpt., Wash., D. C., repairing solaria and roof at Naval Hospital, Spec. 7804, to Redmond Contg. Co., 543 South 46th St., Phila., Pa., $5,185.

†D. C., Wash.—Treas. Dpt. at office Sup. Archt., Wash., D. C., installing elevator in North Building of National Institute of Health, to General Elevator Co., Lexington Bldg., Baltimore, Md., $4,049.

†Ill., Glen Ellyn—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to J. E. Ericsson Co., 123 West Madison St., Chicago, $38,400. Bids Oct. 29. Noted Oct. 11.

†Ill., Rushville—Twenty-First Forestry Dist., 6th Corps. Area, Post Office Bldg., Chicago, bath house, kitchen and mess buildings, six barracks buildings, headquarters building, forestry office quarters, 1st aid building and 1 garage, to Sjostrom & Sons, Inc., Rockford. Bids Oct. 29.

†Md., Beltsville—Dpt. Agriculture, Wash., D. C., elevator at U. S. Experimental Farms, to Warsaw Elevator Co., 156 South Para St., Baltimore, $2,444. Bids Oct. 31.

Mass., Westboro—Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, furnishing, installing laundry equipment in State Hospital, to American Laundry Mach. Co., 801 Beacon St., Boston, $22,614. **P.W.A.** Bids Oct. 25. Noted Oct. 18.

Mo., St. Louis—Kaplan-McGowan Co., general contractors, 315 North 7th St., plastering 4 story, basement, sub-basement, 40x56 ft., two tiers of solaria at City Sanatorium, to J. W. Rowan Plastering Co., 411 North 7th St.***painting, to Beal & McNamara Painting Co., 5078 Easton Ave.***marble, to Midwest Tile Co., 3418 Vista Ave.***terrazzo, to A. Girolami, 4707 Lewis Pl.***electrical work, to Fremder Electric Co., 5071 Delmar Blvd., for Bd. P. Service, City Hall. **P.W.A.** Noted Sept. 13, under "Contracts Awarded."

†N. H., Portsmouth—Treas. Dpt. at office Sup. Archt., Wash., D. C., extending and remodeling U. S. Post Office, to English Constr. Co., 535 5th Ave., New York, N. Y., $42,700. Bids Oct. 29. Noted Oct. 11.

†*Federal Government*

Public Buildings (Continued)

†N. J., Atlantic City—Treas. Dpt. at office Sup. Archt., Wash., D. C., clearing site for post office, to C. D. Heavey Demolition Co., Mount Ephrim Ave., Camden, $3,102. Bids Nov. 1. Noted Oct. 25.

N. Y., Buffalo—R. E. Williams & Son, general contractors, 1,300 tons structural steel for Kensington High School, to Buffalo Structural Steel Co., 166 Dart St., Buffalo***220 tons reinforcing steel, to Concrete Steel Co., Syracuse ***100 tons, to Kalman Steel Co., Hamburg Turnpike and Ridge Rd., Lackawanna, for City. **P.W.A.** Noted Sept. 13.

N. Y., East Rockaway—Bd. Educ., general contract high school, to Jonwal Constr. Co., 220 East 42nd St., New York, $177,300. **P.W.A.** Former contract rescinded. Noted Oct. 25, under "Contracts Awarded."

N. Y., East Rockaway—Bd. Educ., heating and ventilating for high school, to Johnson Heating Co., 306 East 26th St., New York, $29,826***plumbing, to A. E. Ellison, Hewlett, $10,975***electrical work, to Goodrich Electric Co., 166 Lexington Ave., New York, $10,300. Grand total $51,101. Bids Oct. 2. Noted Sept. 27.

†N. Y., Saugerties—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to Murch Bros., 4111 Lindell Blvd., St. Louis, Mo., $37,280. Bids Aug. 31. Noted Aug. 9.

N. C., Greensboro—Bd. Educ., Guilford Co., **(a)** general contract **(b)** plumbing **(c)** heating **(d)** sewage disposal plant for **(1)** White Oak School, 24 rooms and auditorium **(2)** Summerfield School, 6 room addition **(3)** Allen Jay School, 6 room addition **(4)** Rankin School **(5)** Gibsonville School **(6)** Brightwood School, to Southeastern Constr. Co., 218 West 2nd St., Charlotte, **(a1)** $113,158***to Crutchfield-Sullivan, Greensboro **(b1)** $7,630 **(c1)** $23,295 **(c2)** $3,575 **(c3)** $1,295 **(b3)** $840***to Chas. W. Angle, Inc., Greensboro **(a2)** $16,647*** to A. S. Petitt, Inc., Greensboro, **(b2)** $1,750*** to R. K. Stewart & Son, High Point **(a3)** $20,290***to Goode Constr. Co., 111½ East 5th St., Charlotte **(a4)** $5,427***to F. D. Lewis & Son, Greensboro **(d5)** $2,555 **(d6)** $1,931. Grand total $198,123. **P.W.A.** Bids Nov. 1. Noted Nov. 7.

†O., Celina—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to J. Devault, Massillon Rd., Canton, $35,763. Bids Sept. 24. Noted Sept. 13.

O., Tiffin—City, F. Kennedy, mayor, will build city hall with **FERA** labor. Est. $100,000. Traxel, Pahl & Porter, Tiffin, archts. Defeated $50,000 bond issue.

†O., Willoughby—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to J. Grant & Son, 3966 Cargnegie Ave., Cleveland, $41,286. Bids Aug. 29. Noted Aug. 16.

†Pa., Plymouth—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to Berwick Lumber Co., Berwick, Pa., $33,488. Bids Nov. 13. Noted Nov. 1.

†Pa., Sellersville—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to Eastern Constr. Co., 705 Greenwood Ave., Trenton, N. J., $32,800.

R. I., Exeter—State, Emergency P. Wks. Comn., State House, general contract 2 story, basement, 55x115 ft., 15x51 ft., brick, steel dormitory, to E. Turgeon, 36 Exchange Pl., Providence, $109,833***heating, to Taylor Heating Co., 714 Broad St., Providence, $10,890***plumbing, to T. R. Douglas, 8 Slocum St., Providence, $6,690***electrical work, to Brady Electric Co., Inc., 49 Westminster St., $3,075. Grand total $130,488. **P.W.A.** Bids Nov. 15, awarded Nov. 20. Noted Nov. 11.

R. I., Newport — City, H. L. Lowe, supt. Schools, City Hall, structural steel for addition to Potter Grade School, to Providence Steel & Iron Co., 27 Sims Ave., Providence***reinforcing steel, to G. Fred Swanson, Inc., 87 Weybosset St., Providence***stone, to Alex Thomson, Inc., Allens Ave., Providence***marble and tile, to Central Marble & Tile Co., 56 Sanford St., Hartford, Conn. Noted Nov. 1, under "Contracts Awarded."

†Tex., Luling—Treas. Dpt. at office Sup. Archt., Wash., D. C., general contract U. S. Post Office, to A. Blair, 1st Natl. Bank Bldg., Montgomery, Ala., $43,494. Bids Sept. 25. Noted Sept. 13.

Wash., Seattle—Bd. P. Wks., instrument boards for Diablo Power House, to NePage McKenny Co., 804 6th St., $18,903; frequency and load control equipment, to Leeds & Northrup, $7,042. Bids Nov. 8. Noted Oct. 25.

†W. Va., Princeton—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing superstructure U. S. Post Office, to P. W. Johnson Constr. Co., New Martinsville, $59,790. Bids Nov. 9. Noted Oct. 25.

COMMERCIAL BUILDINGS

PROPOSED WORK

Mass., Boston—Boston Lodge of Moose, J. F. O'Connell, 275 Tremont St., plans 4 story, basement, brick, limestone clubhouse, concrete found. To exceed $150,000. Site not selected. Private plans.

N. Y., Brooklyn—Lincoln Savings Bank, 531 Bway., soon lets contract altering heating and plumbing in 4 story, store and apartment, Saratoga Ave. and Sterling Pl. $30,000. A. Goldberg, 164 Montague St., archt. Noted Nov. 8 Daily.

N. Y., Brooklyn—A. Feingold, 1020 East 14th St., plans by Seelig & Finkelstein, 153 Pierrepont St., 6 story, 90x120 ft., brick apartment, Avenue L and East 19th St. $150,000.

N. Y., Brooklyn—E. L. Verran, 825 5th Ave., New York, bids after Mar. 1, general and separate contracts 6 story, 145x160 ft., brick apartment, Atlantic Ave. and Beach 42nd St. $500,000. Scacchetti & Siegel, 1860 Bway., New York, archts. Noted Nov. 8.

N. Y., New York—Home of Sons and Daughters of Israel, 234 East 12th St., plans by H. I. Feldman, 15 West 44th St., altering heating and plumbing in home for aged, 232 East 12th St. $50,000.

N. Y., New York—P. Hyman, 152 Lincoln Blvd., Merrick, plans by B. Sylvan, 15 Nassau St., altering heating, plumbing in four 3 and 5 story apartment, 600 East 14th St. $40,000.

N. Y., New York—Murwin Realty Corp., N. A. Winston, pres., 350 Madison Ave., plans by B. R. Swartburg, 2 West 46th St., heating, plumbing in 12 story apartment, 68 East 66th St. $28,000 or more.

N. Y., New York—Solen Realty Corp., I Solomon, pres., 55 West 42nd St., plans by L. and L. Levy, 527 5th Ave., New York, new incinerator, heating, plumbing alterations in 5 story apartment, 411 East 88th St. $28,000.

N. Y., New York—Three Hundred Thirty-Five East 37th St. Corp., 20 Exchange Pl., plans by A. Lloyd, 13 East 37th St., new boiler room, heating and plumbing alterations in three 4 story apartments, 337 East 37th St. $28,000.

N. Y., Springfield — Frankson Realty Co., 140-68 172nd St., plans by L. Danancher, 147-25 Jamaica Ave., Jamaica, group 12 or more, 1½ story, brick dwellings, 140th Ave. and 174th St. $100,000 or more.

N. Y., Valley Stream—Syndicate headed by B. E. Bursten, Garden City, plans group 20 one-family houses.

Ont., Sarina—Famous Players Canadian Corp., Royal Bank Bldg., Toronto, plans by Kaplan & Sprachman, 305 Dundas St. W., Toronto, theatre, Christina St. $105,000.

BIDS ASKED

N. J., Teaneck—See "Contracts Awarded."

N. J., Tenafly—See "Contracts Awarded."

N. Y., Brooklyn—See "Contracts Awarded."

N. Y., Larchmont—See "Contracts Awarded."

CONTRACTS AWARDED

N. J., Teaneck—Kings Builders, Inc., c/o F. Ingannamorte, Belle Ave., housing development on tract sub-division, Belle Ave., separate contracts. To exceed $100,000. Noted Nov. 1.

N. J., Tenafly—Colonial Colonies Corp., c/o C. Y. Lansing, 67 North Dean St., Englewood, dwellings, etc., on 45 acre residential development, west slope of Palisades, by day labor and separate contracts. To exceed $100,000. Noted Nov. 1.

N. Y., Brooklyn — Clark & Starsberg, 16 Court St., theatre, 94th St. and 4th Ave., separate contracts awarded. $350,000. C. A. Sandblum, 145 West 45th St., New York, archt.

N. Y., Brooklyn—R. L. Goetz, Inc., 311 Marine Ave., 6 story, basement, brick, steel, apartment, 94th St. and Marine Ave., separate contracts. $150,000. J. Gabatchnick, 1838 West 5th St., archt. Noted Nov. 15.

N. Y., Brooklyn—Translux Theatre, Inc., theatre, 927 Flatbush Ave., to M. Shapiro & Sons, 1560 Bway., New York. Est. $100,000. Contractor awarded all separate contracts. Noted Sept. 20.

N. Y., Brooklyn—Five Thousand Eight Hundred One 14th Avenue, Inc., 291 East 3rd St., 6 story, 84x180 ft., brick apartment, plain found., Ocean Ave. and Albermarle Rd., separate contracts. $170,000. Seelig & Finkelstein, 153 Pierrepont St., archts. Noted Nov. 15.

N. Y., Brooklyn—W. Robb, 465 East 95th St., 6 story, brick apartment, 52nd St. and 15th Ave., separate contracts. $125,000. Kavy & Kavovitt, 16 Court St., archts. Noted Nov. 15.

N. Y., Laurelton—Laurelton Homes, 160-16 Jamaica Ave., Jamaica, group dwellings, Merrick Rd. and 230th St., separate contracts awarded. To exceed $100,000 or more. Noted Nov. 1.

N. Y., Larchmont — C. W. Moody, Althea Lane, group dwellings in Rouken Glen, near here, day labor and separate contracts. To exceed $100,000. Noted Nov. 1.

INDUSTRIAL BUILDINGS

PROPOSED WORK

O., Cincinnati — POWER PLANT — Kroger Grocery & Baking Co., 35 East 7th St., soon lets contract power plant equipment, incl. boilers. Tietig & Lee, 34 West 6th St., archts. Fosdick & Hilmer, Union Trust Bldg., engrs. Noted Oct. 11.

BIDS ASKED

Colorado — MINING DEVELOPMENT — See "Contracts Awarded."

N. Y., Albany—FACTORY—A. P. W. Paper Co., 1273 Bway., D. W. Hollister, in charge, taking bids constructing Liberty paper mill addition and equipment. $400,000. Noted **Nov. 1.**

O., Cincinnati—RECTIFYING PLANT—K. J. Kiefer, engr., Schmidt Bldg., taking bids on separate contracts 2 story, liquor rectifying plant, Spring Grove Ave., for Ferrin Estate, Spring Grove Ave., c/o engineer. To exceed $28,000. Kolmar, Inc., Spring Grove, lessee.

O., Lorain—PLANT—Intercity Products Co., Lorain, taking bids general and separate contracts 2 story, 80x120 ft. plant addition. Est. about $28,000.

O., Middletown—SERVICE STATIONS—See "Contracts Awarded."

Tex., Alice—OIL REFINERY PLANT—See "Contracts Awarded."

Tex., Harlingen—BOTTLING PLANT—Nehi Bottling Wks., c/o F. J. Garrett, pres., taking bids and opens same about Dec. 5, 1 story, 40x90 ft., brick, rein.-con. bottling plant. $35,000. Private plans.

CONTRACTS AWARDED

Ala., Crichton—PLANT—Mobile Paper Co., plant addition, to Mobile Steel Co., Mobile. Est. $80,000.

Colorado—MINING DEVELOPMENT—Shafter Mining Co., c/o F. I. Collom, Idaho Springs, developing mining properties, tunnelling, timbering, etc., various locations, day labor. To exceed $50,000. Noted Nov. 15.

Ill., Peoria—WAREHOUSE—Hiram Walker Co., 10 story, part basement, 150x180 ft., brick, stone, concrete, steel, plain found., to Val. Jobst & Sons, Peoria. Smith, Hinchman & Grylls, 800 Marquette Bldg., Detroit, Mich., archts.

Me., Portland — DISTRIBUTION PLANT — Crane Co., 836 South Michigan Ave., Chicago, Ill., distribution plant, to Coogins-Clark Constr. Co., Portland. Est. $30,000 or more. Webster & Libby, 443 Congress St., archts.

Mass., Cambridge—SERVICE STATIONS—Atlantic Refining Co., C. J. Cutting, 144 Passyunk Ave., and C. H. Ehlers, 260 South Broad St., Phila., Pa., constructing two 1 story, brick, concrete super service stations, 1 on Chilton St. and other on Mass. Ave., to Frankini Constr. Co., 30 Mystic Ave., Medford.

Mass., Lynn—GARAGE—Eastern Mass. St. Railway Co., 38 Chauncey St., Boston, electrical work for brick, steel bus garage, to Kenworthy & Taylor, 11 Spaulding St., Everett; plumbing, to Lappin Bros. Co., 17 Irving St., Malden. Noted Oct. 11, under "Contracts Awarded."

Mass., Woburn — GLUE FACTORY — Austin Co., general contractors, 19 Rector St., New York, electrical work for 2 story, basement, 142x588 ft. glue manufacturing plant, for New England Chemical Industries, Inc., 500 5th Ave., New York, to Anderson Coffey Co., 22 Shawmut St., Boston. Awarded Nov. 13.

Mass., Attleboro—FACTORY—General Plate Co., Foster St., R. Willard, mgr., heating, sprinkler for 2 story, 50x100 ft., brick, steel factory addition, to Grinnel Co., Inc., 260 West Exchange St., Providence, R. I.; electrical work by owner. Noted Nov. 22, under "Contracts Awarded."

Mich., Battle Creek—PLANT—George Weston Co., 134 Peter St., Toronto, Ont., Canada, and Passaic, N. J., cracker and biscuit manufacturing plant, separate contracts awarded. To exceed $100,000.

Neb., Omaha — GALVANIZING PLANT — Ferer Galvanizing Corp., 101 South 8th St., general contract brick, steel, cement galvanizing plant, 812 Douglas St., to C. Peterson, Omaha. Est. $30,000.

O., Bernard—POWER HOUSE, etc.—Cincinnati Chemical Wks., Norwood, 2 story, 58x70 ft. power house and plant, Murray Rd., to M. Marcus Building Co., 2111 Reading Rd., Cincinnati. Est. exceeds $50,000. Tieg & Lee, 34 West 6th St., archts., and W. E. Bodenstein, 2nd Natl. Bank Bldg., engr., both in Cincinnati.

O., Columbus—FACTORY—Clark-Gray Vault Co., 373 East 5th St., 1 story, 53x260 ft. factory, to L. Rusinger, 311 Sherborn Dr. Est. $40,000.

O., Middletown—SERVICE STATIONS—Producers Oil Co., 401 South Main St., Dayton, group of service stations, here, and other Ohio locations, separate contracts and day labor. $30,000 or more.

R. I., Providence — BREWERY — James Hanley Brewing Co., 35 Jackson St., general contract altering brick, concrete brewery, Jackson and Eddy Sts., to Sullivan Constr. Co., Inc., 357 Westminster St.; brewery equipment, to Geo. F. Gott Co., Hoboken, N. J. Est. $150,000. Noted May 18.

Tex., Alice—OIL REFINERY PLANT—Emmert & Emmert, Corpus Christi, and Alice, constructing oil refinery plant, own forces. Est. $75,000. Private plans.

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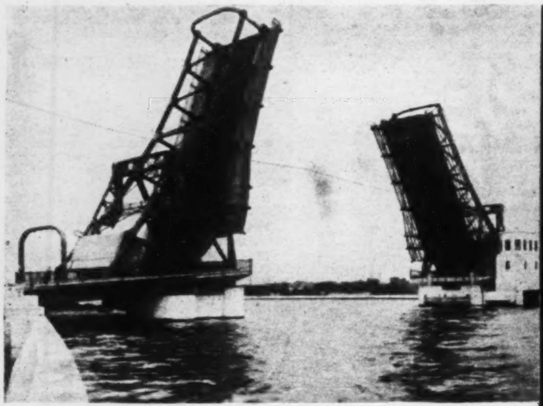
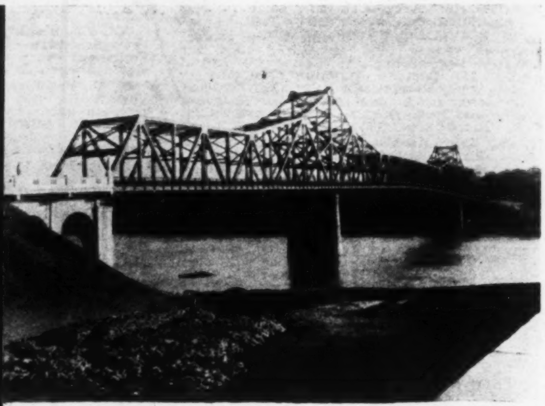
†Federal Government.

For official proposal advertising see Searchlight Section

Construction - - - -

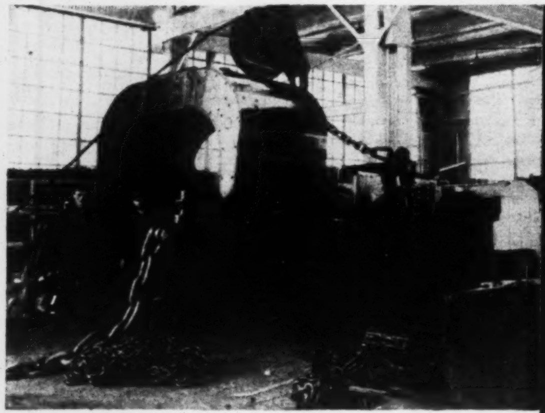


Bridge over Lakes to Gulf Waterway at McDonough Street, Joliet, Illinois, built of Inland Steel during 1933.

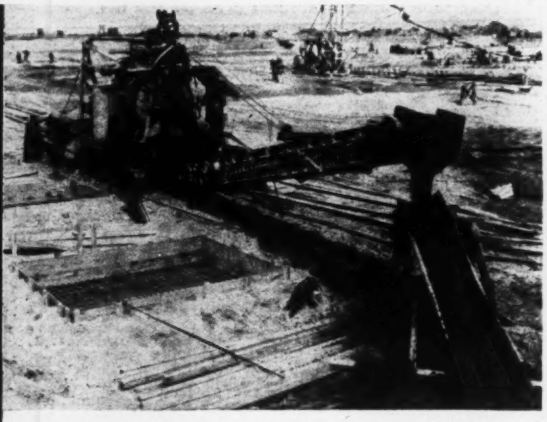


Hilliard Bridge, Ottawa, Illinois, built of Inland Steel. 1000 ft. span—250 ft. from abutments to piers, 500 ft. between main piers.

Construction Equipment - - - -



12 cu. yd. dragline bucket made of Inland Steel, as was the dragline excavator with 160-ft. boom to handle this huge bucket.



This large concrete mixer, as well as much other construction equipment, is built of Inland Steel by an important manufacturer.

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